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Martin
Orne

Naval
Robo Research

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MARTIN T. ORNE (1 Of 7)

Director of the Unit for Experimental Psychiatry , Univ. of Penna. Hospital and PRofessor of Psychiatry at Univ. of Penna.
M.A. & PH.D. From Harvard U. '51 &'58; M.D. from Tufts Univ. Med School 1955. Internship at Michael Reese Hosp '56, completed residency Massachusettes Mental Health Ctr. '60.
Senior Research Psychiatrist at Mass. Ment. Hlth Ctr & Associate in Psychiatry at Harvard Med Schl.
Director of Hypnosis Project '58-'64.
In '64 the research lab moved from Harvard to Penna. Hospital. The research group has continued ass the Unit fro Experimental Psychiatry with studies concerning the nature of hypnosis remaining one of its principal interests.

The "Studies in Hypnosis Project" at Harvard & Mass Mental Hlth Ctr was funded by Air Force Office of Scientific Research & Society for Investigation of Human Ecology.

Orne's doctoral dissertation at Harvard 1957, THE NATURE OF HYPNOSIS: ARTIFACT AND ESSENCE, was published in the Journal of Abnormal Psychiatry in 1959. This study, used a group of unsuseptible subjects who were treated experimentally like real hypnotic subjects but who fake hypnosis by intensive role playing without otherwise going into a trance.

This experiment series gave birth to Orne's celebrated theory,

TRANCE LOGIC = critical difference between hypnotic and waking behaviors seem to rest entirely in the altered subjective perceptions of the subject. The hypnotized individual can be identified only by his ability to re respond to suitable suggestions by appropriately altering any or all modalities of perception and memory.

The deciding test is if the S can believe as real two hallucinations of the same figure in the room at the same time, without questioning their validity.

Orne had much work published on the phenomena of simulating hypnosis and real hypnosis... individuals are able to simulate H sufficiently well to decieve trained hypnotists.

POST H AMNESIA::

"Highly suggestible S respond to suggestions on pure fantasy levels in accordance to their own fantasies in equivalent passive response."
...as we forget vivid fantasies indour dreams, amnesia besets post-hypnotic experience."

******* ******

Harvard Group Scale Of Hypnotic Suseptibility :

developed 1962 by Orne & Ron Shor

showed:

ability to perform divergent thinking tasks under H

women more creative under H than men (196)
women more suseptible to H than men (1966)

H subject plays his role somewhat differently than waking simulato

*

DEPARTMENT OF THE NAVY
OFFICE OF NAVAL RESEARCH
ARLINGTON, VIRGINIA 22217

IN REPLY REFER TO
100L:PMH:esb
15 DEC. 1975

Mr. Tom Miller
P. O. Box 50842
Tucson, Arizona 85703

Dear Mr. Miller:

This is to acknowledge your letter of 28 November 1975 pursuant to Freedom of Information regarding "the ONR Committee on Hypnosis."

We have retrieved the files relating to Dr. Orne's contract from the archives. They have been examined in terms of the questions you raised in your letter of 13 November 1975. Unfortunately, this turned out to be an unproductive exercise. Those files contain only oblique references to meetings of what Dr. Orne called "the ONR Committee on Hypnosis." However, one of our staff members, who was not directly associated with the research program, has been helpful in supplying some recollections regarding the "committee" to which you referred.

First of all, the "ONR Committee on Hypnosis" is a misnomer. A loose-knit informal interest group of researchers did exist for several years. They were bound together by a common interest in the broader research area of "higher states of consciousness." The group did strive to "keep abreast of developments" in the experimental study of hypnosis and other related topics. But it did not have the status of a Committee in any formal sense; there was no charter, no bylaws, no proceedings, minutes, etc. Its principal purpose was to promote the informal exchange of scientific information. The ONR "sponsorship" was limited to the payment of travel expenses for those participants who did not have their own sources of support. The ONR Scientist was motivated to do this in order to receive program guidance and to keep abreast of research activities in this area. Certainly, the group had no granting authority (as might be implied from Dr. Orne's comments). It apparently varied in size from seven to ten people. During its early years, it met every two or three months at the institutions or laboratories of the participants. The frequency of these meetings dropped off gradually, probably stopping altogether in about 1967.

I trust that this information will be useful to you. If I can be of any further assistance in this matter, please feel free to contact me at:

Department of the Navy
Office of Naval Research (Code 100L)
Arlington, Virginia 22217

Philip M. Hitch

PHILIP M. HITCH

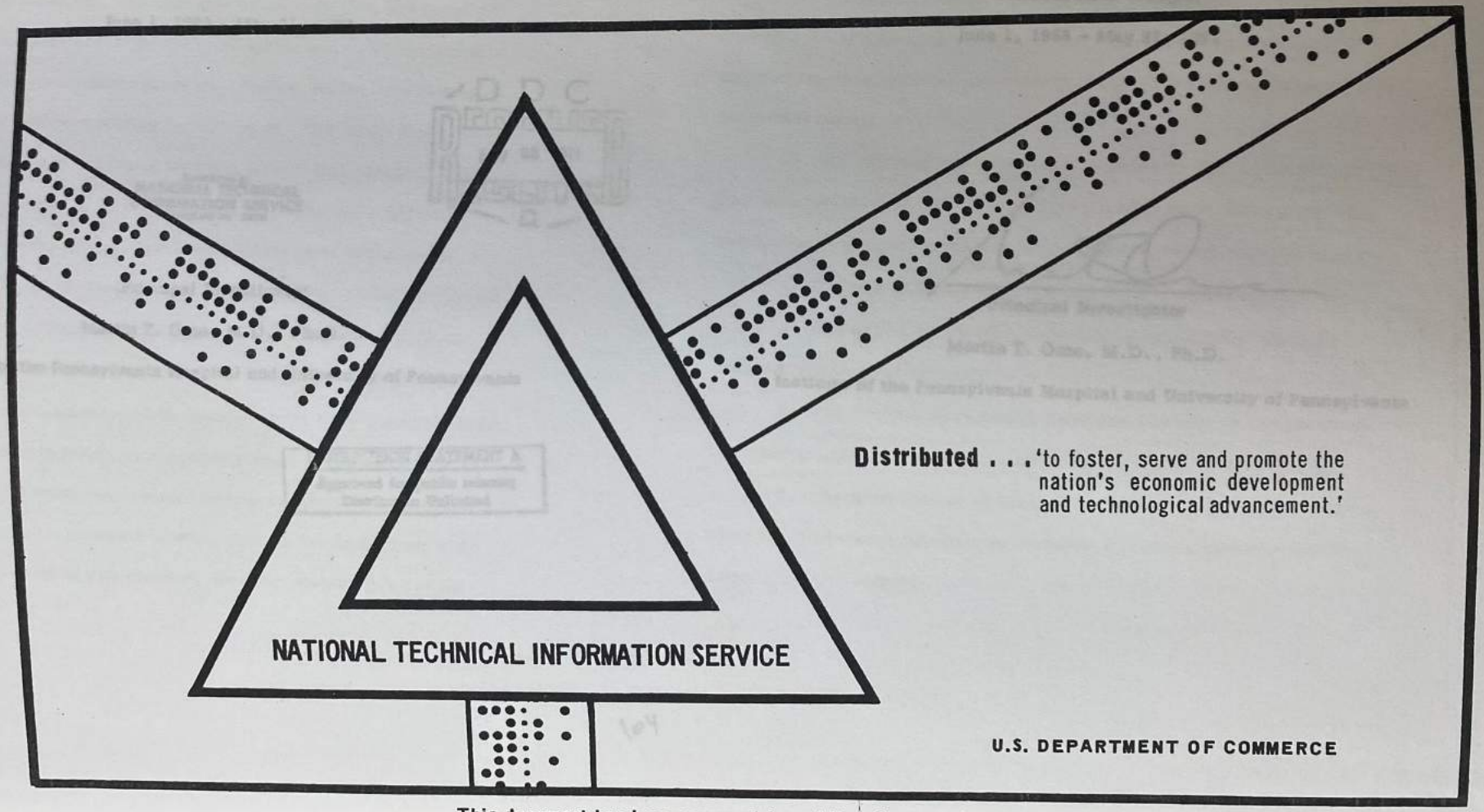
AD-732 801

FINAL REPORT OF WORK CARRIED OUT UNDER OFFICE OF NAVAL RESEARCH CONTRACT NONR-4731(00), JUNE 1, 1968 - MAY 31, 1971

Martin T. Orne

Institute of the Pennsylvania Hospital
Philadelphia, Pennsylvania

31 May 1971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June 1, 1968 - May 31, 1971

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Principal Investigator

Martin T. Orne, M.D., Ph.D.

Institute of the Pennsylvania Hospital and University of Pennsylvania

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This report will summarize the work we have carried out for the Office of Naval Research. The work was initiated in 1962 and concluded in 1971, and has resulted in over 30 publications and an equal number of reports presented at scientific meetings. Several manuscripts remain in preparation and will be published in due course. Two books were a direct outgrowth of this work: a book of readings entitled The Nature of Hypnosis by Shor and Orne, and the proceedings of an international symposium, which brought together investigators from various parts of the world, entitled Psychophysiological Mechanisms of Hypnosis, edited by Chertok.

The contract itself was an outgrowth of the ONR Committee on Hypnosis which served to keep abreast of developments in hypnosis. The ONR Committee was originally set up because of the Navy's concern with the possible uses of hypnosis as a technique to maximize resistance to stress; to facilitate persuasive communication; to control behavior over time; and to interrogate prisoners of war. Through the Committee, and subsequently by means of this contract, the Navy assured itself of the

necessary competence to evaluate the potential military uses of hypnosis and related phenomena. Though the work carried out on this Contract was, in large measure, basic research, the conceptual questions addressed dealt with issues central to the potential offensive and defensive uses of hypnosis in a military setting.

Our research has focused on several broad areas.

1. The development of techniques to permit a scientific investigation of hypnosis by designing appropriate control procedures and useful experimental paradigms.

2. The detailed exploration of posthypnotic behavior, studying its duration, its effectiveness compared with other means of controlling behavior; and the circumstances under which it becomes an effective means of behavioral control.

3. The effect of hypnosis on motivation and task performance. This work was initially based on the assumption, later shown to be erroneous, that increased motivation is an intrinsic characteristic of hypnosis.

4. The use of hypnosis as a means of controlling physical pain.

5. The search for reliable behavioral or psychophysiological criterion measures of hypnosis.

6. The alterations of mental functions that may be brought about by hypnosis, particularly using posthypnotic amnesia as a model.

7. The investigation of hypnosis, suggestibility, placebo and other forms of social influence as techniques of persuasive communications.

A. METHODOLOGICAL STUDIES

Though the laboratory experiment has been an extremely powerful tool in the physical sciences, its use in the social sciences and particularly in psychology has been considerably more controversial. Clearly, laboratory studies make possible a degree of experimental control that cannot be achieved in the field. One may systematically vary parameters in a fashion not possible in "real life" contexts. On the other hand, laboratory studies, particularly with human subjects, are easily influenced by subtle yet powerful variables unique to the laboratory situation, due to the fact that the human experimental subject recognizes his role and responds not only to the experimental stimuli but to the total context. The issues of ecological validity are central to any attempt to apply findings from laboratory research to life situations. These issues, ubiquitous to all experimental studies with man, are particularly serious in research dealing with hypnosis.

It is by no means accidental that the significance of demand characteristics was first clearly enunciated as a consequence of a hypnosis study (Orne, 1959). Until techniques to evaluate the effects of demand characteristics and related variables were developed, rigorous reliable research in hypnosis was extremely difficult. The basic development of a methodology to investigate hypnosis was recently outlined in an article for Naval Research Reviews (Orne, 1970), and it will be discussed only briefly. The approach, however, has had considerable impact on the understanding of psychological research in many areas. Several

significant studies dealing with important methodological questions have been supported under this contract (Evans, 1966a, 1968; Evans & Orne, 1965, 1971; Orne, 1965, 1966a, 1967a, 1969a, 1970a, 1970b, 1970c, 1970d, 1970e; Orne & Evans, 1966; Orne & Holland, 1968; Orne, Sheehan, & Evans, 1968; Shor & Orne, 1965). Of particular importance is the development of the concept of demand characteristics and quasi-control techniques to allow the investigator to evaluate the effects of situational factors, expectations, demand characteristics, etc., as opposed to the specific independent variable under investigation.

The Simulating Control in Hypnotic Research.

We have clarified and expanded our understanding of the simulation quasi-control design as a means of drawing inferences about hypnosis. This procedure compares behavior of simulating unhypnotizable individuals with that of deeply hypnotized subjects. Individuals are asked to simulate hypnosis for an experienced hypnotist and are told--correctly--that they will be run by an experienced hypnotist who does not know which subjects are hypnotized. Under these circumstances, simulators behave similarly to deeply hypnotized individuals and, without special test procedures, cannot be distinguished from hypnotized subjects. The experimenter is kept blind as to the true nature of the subject. Therefore, differences between the behavior of these two groups cannot be ascribed to different treatment procedures by the hypnotist; by the same token, if simulating subjects behave in an identical fashion to hypnotized individuals, it is clear that a particular experimental procedure is not adequate

to distinguish these two groups. The simulating control technique has been particularly important in three types of situations.

Transcendence of Normal Capacity. It is often claimed that physical and mental performance during hypnosis transcends waking behavior. It is difficult to set up waking procedures that maximize motivation and assure similar treatment. The simulation technique is an excellent procedure for testing the limits of motivated waking performance. For example, previous reports indicated that apparently involuntary optokinetic nystagmus eye movements would serve as a criterion of the veridicality of hypnotically induced hallucinations (Brady & Levitt, 1964). We (Evans, Reich, & Orne, in preparation) were able to show that simulating subjects could also produce nystagmus, indicating the nystagmus eye movements could be brought under voluntary control in some circumstances, thereby showing that nystagmus was not an adequate criterion of hypnotic hallucination (see also Graham, 1970a, 1970b, 1970c; Reich, 1970a, 1970b).

As in the other situations described below, simulation techniques and quasi-controls are not always the most appropriate methods to explore specific questions. When investigating motivation and performance during hypnosis, designs such as those introduced by London and Fuhrer (1961), and subsequent modifications (Evans & Orne, 1965; McGlashan, Evans, & Orne, 1969) may be more appropriate.

Counterexpectational Effects of Hypnosis. The behavior of simulating subjects provides an excellent yardstick for discovering how

subjects might think they should behave in the hypnotic situation. If hypnotized subjects perform differently from the behavior determined by expectations, then this is particularly convincing.

Posthypnotic source amnesia (Evans, 1970; Evans & Thorn, 1966) is an example of such a counterexpectational effect of hypnosis. During hypnosis, subjects are taught some rather esoteric information such as the color an amethyst turns when it is heated. Some hypnotized subjects who otherwise have complete amnesia for all hypnosis events quickly answer, correctly, "yellow" when asked posthypnotically what color a heated amethyst turns, but do not know they were just told this during hypnosis. In contrast, when asked about the color of an amethyst posthypnotically, simulating subjects invariably answer, "I don't know"--responding to the obvious cue that they should forget everything that transpired during hypnosis. Source amnesia is counterexpectational in the sense that it is a phenomenon of hypnosis which runs contrary to the expectations subjects have about how hypnotized subjects should respond to the procedure.

There is one special limitation in using the simulating procedure to demonstrate whether a phenomenon could be most conservatively interpreted as an artifact of expectations. If an effect involves a real subjective hypnotic phenomenon which is concordant with the expectations of nonhypnotized simulating subjects, this cannot be shown using the simulation design. The simulating procedure is limited to demonstrating the unexpected. In this sense, of course, it is an extremely

conservative procedure.

The Evaluation of Deception. A third situation in which the simulator design is invaluable occurs when it is necessary that the experimenter deceive experimental subjects. The behavior of the simulating subjects will provide convincing evidence whether it is the subject or the experimenter who is being deceived.

Two studies are described in subsequent sections illustrating this particular application of simulating controls. One concerns the effect of an inadvertent interruption of a tape-recorded hypnosis session (Orne & Evans, 1966; Evans & Orne, 1971). The second study is concerned with whether posthypnotic behavior will occur in a private setting outside of the experimental context (Orne, Sheehan, & Evans, 1968).

Valid Inference and the Simulation Design.

Over the years quasi-controls have been misunderstood and misinterpreted by several investigators. These misunderstandings appear to be related to reinterpretations of the purpose of quasi-controls as standard control groups classically used in the hypothetico-deductive model of experimental design. We have consistently pointed out that the simulating subject design is not a standard passive control group, but rather is an active technique whereby the experimenter can evaluate the experimental situation to determine what surplus meaning is conveyed in the situation which might provide alternative interpretations of the experimental data. Provided the experimenter cannot distinguish between hypnotized and simulating subjects, he must treat them alike. Whatever

demand characteristics and situational factors influence the behavior of simulators are potentially available to influence the behavior of hypnotized subjects.

If there are no differences between the behavior of simulating and hypnotized subjects, the experimenter can only make a conservative and parsimonious conclusion that the behavior of the hypnotized subject may have resulted entirely from the same set of cues available to the simulator. Just as the statistician may unwittingly make a Type II error, so too it may be that some other mechanism has determined the hypnotized subject's behavior. There is, of course, no way of testing this in the context of the simulator design.

The interpretation of differences in behavior of real and simulating subjects is even more fraught with danger. It is stressed that no conclusion of the null hypothesis kind is appropriate--in a direct sense a hypothesis cannot be tested using only this design. If the hypnotized subject behaves differently from the simulating subject, we know only that his hypnotic behavior is likely not to be attributed to the cues and procedural "nitty gritty" available to the simulator in the absence of any hypnotic experience. Thus, in a procedural situation shown by simulating subjects to be valid, the behavioral effects of hypnosis are demonstrated. The nature and mechanisms of these behavioral effects of hypnosis require subsequent hypothesis-testing experimentation, using different methodologies.

Inference in Simulation Designs: The Disappearing Hypnotist.

The problem of inference with quasi-controls is illustrated in two studies (Evans, 1966b; Evans & Orne, 1971; Orne & Evans, 1966) in which we investigated what happened when the experimenter disappeared after hypnosis has been induced. This is not an easy question to resolve. The hypnotist's disappearance must be managed in such a way as to seem plausible, truly accidental, and in accord with the implicit agreement between subject and hypnotist that the latter is responsible for the welfare of the former during the course of the experiment.

Two sessions were conducted with subjects previously trained to enter hypnosis readily. All instructions, including the induction and termination of hypnosis, were administered by tape recording. The experimenter's task became essentially that of a technician--turning on the tape recorder, applying electrodes, presenting experimental materials, etc.

During the second session, while the subject was deeply hypnotized and tapping his foot in rhythm with hallucinated music, the tape recorder came to a grinding halt, the light on the desk went out, and the experimenter tried in vain to reactivate the machine by flicking the switch. He then muttered under his breath that the fuse must be blown and dashed from the room. The subject's behavior was observed through a one-way screen in order to discover what happened when the experimenter left the room. Would hypnosis be terminated immediately once the subject was alone, as some theories would predict, or would it take a period of time for the subject to pull himself out of hypnosis, as one would expect if

the condition was some special altered state?

Despite the "cuteness" of the deception procedure of the simulated power failure, there was no certainty that subjects would accept it as such. For this reason simulating quasi-controls were run. The findings were clear-cut: five out of the six deeply hypnotized subjects did not rouse immediately when the hypnotist left. They required varying periods of time to pull themselves out of the state. When they did, they appeared somewhat disoriented and confused. However, five out of the six simulating subjects also continued to simulate hypnosis after the experimenter left the room. In fact, they did "better" than the real subjects and feigned trance until the technician returned half an hour later! Although it was evident from their behavior, the simulators confirmed during the subsequent postexperimental inquiry that they caught on to the fact that the power failure was contrived. They behaved as they thought a hypnotized subject would if there had been a true power failure.

Because the quasi-control subjects are a special treatment group their purpose is not primarily to provide comparison objects for actual subjects; rather, it is to clarify the adequacy of the experimental procedure. Since the simulators caught on to the fact that the power failure was contrived, it was possible that at some level the hypnotized subjects had also responded to the same cues, even though they did not verbalize such awareness. Therefore, despite statistically significant differences between these two groups, the results did not permit any conclusions to be drawn about the nature of hypnosis. Rather, the behavior of the quasi-

controls demonstrated the inadequacy of the deception procedure, and indicated that the behavior of the hypnotized subjects could not be confidently interpreted at face value.

Having found the deception manipulation wanting, we reëxamined in detail the cues which might have allowed the subjects to become aware that the "power failure" was a planned part of the experiment and that his behavior would actually be observed. The kind of "nitty gritty" details which most investigators fail to publish and which, even if they wished to, most editors would delete for the sake of brevity, are crucial in this regard. To facilitate observation after the "power failure," the overhead lights remained on and only the bright desk lamp went out as the tape recorder stopped; an obvious one-way mirror to which we hoped (in vain) that the subject would have adapted remained in the room; and further, a small polygraph continued to run in the experimental room after the "power failure." We redesigned the study with considerable attention to such details. The one-way screen was eliminated and replaced by another less well known and carefully hidden means of observation. When the "power failure" occurred all lights in the room were extinguished. Just enough light was filtered into the room through the window curtains from daylight--or from a strategically placed parking light outside at night--to make observation possible. Furthermore, physiological recordings were ostensibly made by means of a large Ampex instrumentation tape recorder and a small polygraph. Both of these machines stopped, along with the lights and the tape recorder, at the "power failure."

(Actually the wires from the subject were run through to another room at some distance in order to permit continuous recording of relevant data.) When the experimenter left the room the hall lights were out. Every effort was made by scrupulous attention to such details to have the "power failure" appear genuine.

With these revised conditions simulating and hypnotized subjects were run in another experiment by a blind experimenter. This time five out of six simulating subjects stopped simulating the moment the technician left the room, and indulged in exploratory or other private behavior, clearly indicating that they felt that they were unobserved. On the other hand, the hypnotized group behaved much as they had in the earlier experiment, pulling themselves out of the state only after a considerable period of time had elapsed. This behavior was in line with the data provided during an inquiry, which indicated that both real and simulating subjects accepted the "power failure"as genuine.

Significant differences were again obtained but, in contrast to the findings of the first study, those from the second study allow meaningful inference. The behavior of the quasi-controls clearly indicates that the"power failure"was accepted as genuine, and therefore it is legitimate to accept the behavior of the hypnotized individuals at face value.

B. STUDIES OF POSTHYPNOTIC SUGGESTION

A deeply hypnotized individual, instructed during hypnosis that at some later time he will carry out an item of behavior in response to a specific cue, will tend to do so, often without awareness that he is carrying out a suggestion. In fact, posthypnotic suggestion has often been used as one of the demonstrations of unconscious motivation. Though it is well established that suitable individuals will carry out even bizarre posthypnotic suggestions, it has not been shown to what extent the posthypnotic response depends upon the relationship between subject and hypnotist as opposed to the fact that the suggestion is given during hypnosis. Again, the importance of posthypnotic amnesia is by no means clear in this context. Clinicians report that the main limitation of posthypnotic suggestion during treatment is that the strength of the suggested impulse decays over time.

Three studies on posthypnotic suggestion will be summarized (Damaser, 1964; Nace & Orne, 1970; Orne, Sheehan, & Evans, 1968). They have been published previously, and the implications of these and other studies have been discussed in a previous Technical Report (Orne, 1969c).

1. Strength of a Posthypnotic Suggestion

Our first study involved an attempt to determine how effective posthypnotic suggestion could be over time compared with a simple waking request. Pilot studies suggested that mailing a stack of postcards, one a day, would provide an adequate criterion.

Procedure.

Three groups of deeply hypnotizable subjects were tested. The subjects in the first group were hypnotized and given a posthypnotic suggestion that they would mail one of 60 postcards to the experimenter until they had mailed all of the 60 cards. The subjects were then awakened and told the experiment was completed. The second group of subjects were deeply hypnotized and given the same suggestion. In addition, when each subject awakened it was explained to him that the experimenter wanted him to do something that was very important--to send a postcard each day. Thus, this group was given the posthypnotic suggestion, and was also requested in the waking state to carry out the same behavior. Finally, the last group was deeply hypnotized but not given any posthypnotic suggestion at all. Instead, upon awakening, they were given a stack of postcards and asked to send one every day. This group had only the awake request.

Results.

The overall findings were somewhat surprising; namely, the subjects who received the posthypnotic suggestion alone sent fewer postcards than both groups who received the request in the awake state.

Discussion.

It appears that those subjects who were in the posthypnotic group correctly surmised that the purpose of the experiment was to determine how long a posthypnotic suggestion would last. When their compulsion to carry out the suggested behavior waned they did not feel it appropriate

to force themselves to continue to send the cards, since to do so seemed to them to be "cheating." In contrast, those subjects in the waking request group felt that it was very important for the success of the experiment that they continue to send postcards as long as possible.

A mere waking request was more effective in eliciting postcard-sending under these circumstances than posthypnotic suggestion. However, we should not lose sight of the fact that subjects given the posthypnotic suggestion alone did send a considerable number of postcards. Of perhaps equal interest is the implication of these data for the naive concept that poshypnotic suggestion can somehow be explained as a subject's simply cooperating with an experimenter. If this were the case, subjects responding to posthypnotic suggestion would have sent a great number of postcards. That this is not the case strongly supports the view that we are dealing with a qualitatively different kind of phenomenon.

2. Posthypnotic Suggestion Outside the Experimental Situation

An entirely different approach to an understanding of posthypnotic behavior follows from the work of Fisher (1954). Fisher suggested to deeply hypnotized subjects that, on awakening, each time they heard the word PSYCHOLOGY they would scratch their right ear. After the cue word was able to elicit the suggested behavior, one of his associates came into the room, implying the experiment was terminated. In the course of an informal conversation the word PSYCHOLOGY came up spontaneously. Of the 12 subjects, only three responded. After the associate left, the experimenter implied the experiment was to continue. All of the

subjects resumed responding to the posthypnotic suggestion. Fisher concluded that the posthypnotic response is a function of the subject's expectations of what is desired which would be carried out only as long as he believed the experiment was still in progress.

In a recent study (Orne, Sheehan, & Evans, 1968), we hypothesized that Fisher's subjects may have perceived the original suggestion to be that they ought to respond as long as the experiment continued, since the request to do so indefinitely would not be a plausible one. If this were so, it would be expected that the subjects would stop responding when they believed the experiment to be over. From our point of view the Fisher study does not really test whether a subject who is given a clear-cut, time-limited posthypnotic suggestion will carry it out even under circumstances which he perceives to be outside of the experiment,where the hypnotist would be unlikely to know or even care whether the suggestion had been carried out.

Procedure.

The subject was required to come to the laboratory on two succeeding days. The first day, subjects were given the suggestion in deep hypnosis that for the next 48 hours each time they heard the word EXPERIMENT they would run their right hand through their hair. This suggestion was legitimized by the fact that subjects knew that they would see the hypnotist on the succeeding day. The suggestion itself, however, was clear-cut and explicit in placing a 48-hour time limit on its effectiveness.

Each subject, on the completion of the first day's tests, returned

to the secretary who asked him to sign the usual form, asking whether it would be all right to pay him "now for today's EXPERIMENT and for the next part of the study tomorrow." The subject's response under these circumstances, in a different room totally outside the experimental context, constituted the first criterion test. On returning the subsequent day the subject was met by the receptionist who asked whether he was participating in the physiological or the psychological EXPERIMENT. The subject's response to the receptionist constituted the second test.

Results.

Highly selected subjects who were capable of entering deep hypnosis responded in the waiting room and the main office much as they had in the presence of the hypnotist. The fact that the context was different, the experimenter was not present, and that the test was carried out in a way that appeared totally unrelated to the study, did not seem to interfere with the response.

One of the methodological problems in this study was whether the test by the secretary was truly perceived to be outside of the experimental session. If somehow the way in which the study was carried out allowed subjects to suspect that the secretary was really recording their behavior for the benefit of the hypnotist, the findings would have little relevance to the question whether posthypnotic response generalizes from one context to another. For this reason we ran a special treatment group of simulating subjects in order to ascertain how likely it might be that subjects could catch on to the fact that the secretary was really a part of the

experimental procedure. Of 17 deeply hypnotized subjects, 6 responded on both days. These differences are particularly striking since in the presence of the hypnotist the simulating subjects tended to respond more often, but in his absence the probability of their response was significantly less.

These data would seem to indicate that the posthypnotic suggestion is different in kind from the responses to request. This finding is congruent with the observations of Damaser (1964), Edwards (1963), Kellogg (1929), and Patten (1930), all of whom found that the waking request is significantly more powerful in eliciting behavior over a long period of time than the posthypnotic suggestion. Thus, we were particularly pleased to be able to demonstrate experimentally the kind of circumstances where the posthypnotic suggestion is more effective than a request--if we interpret the behavior of the simulating subjects as responsive to a request. The deeply hypnotized subject appears to respond to a posthypnotic suggestion given in a way that communicates the intent that it should be carried out over a period of time--regardless of whether the hypnotist is present or whether the context demands a response.

3. The Fate of an Uncompleted Posthypnotic Suggestion

A recent experiment (Nace & Orne, 1970) explored what might happen to posthypnotic suggestions that are not carried out. It seemed likely that while the response to a posthypnotic suggestion is usually seen as an all-or-nothing matter, there must be instances when there is a considerable impulse to carry out the posthypnotic suggestion but

various inhibitory impulses prevent the execution of the action. An experiment was designed which would try to grasp this type of phenomenon.

Procedure.

The subjects were hypnotized at three different times by two different investigators, using SHSS:A, B, and C. During the third session when the subject was administered SHSS:C, the posthypnotic suggestion was given that on awakening, when the hypnotist removed his glasses, the subject would feel compelled to pick up the blue pencil from a pencil box on the desk and play with it.

The deeply hypnotized subject would, of course, respond to this posthypnotic suggestion. We reasoned, however, that some subjects might have an impulse to carry out the posthypnotic suggestion, but it might not be sufficiently strong to lead to the actual behavior. By creating a situation where, in order to fill out a questionnaire, the subject would require a writing implement, he could, without necessarily even being aware of it, choose to use the blue pencil rather than one of the several other pencils present in the box.

Accordingly, at the completion of SHSS:C, the hypnotist took off his glasses. He then indicated that there would be a questionnaire to fill out. As soon as the subject sat down in the chair, the experimenter left the room. While left alone in the room, the subject could use any one of the writing implements in the pencil box or a pen or pencil that he might have had with him. We expected to be able to show that the choice of a blue pencil while filling out a questionnaire subsequent to hypnosis

would be lawfully related to the other tests of hypnotizability which were carried out earlier both during the same session and during previous sessions, and that the use of the blue pencil under these circumstances constituted a response similar to that of carrying out the posthypnotic suggestion on cue but that it would require less hypnotic depth to achieve it.

Precautions were taken to have pencil wells with a standardized number of pencils and colors throughout the laboratory in order both to make certain that subjects would not see these as something special for the experiment on the one hand, and to obtain reliable baselines of pencil choices over a period of time. The occasional subject who showed a preference for blue pencils prior to the posthypnotic suggestion was excluded from the study.

Results.

Several subjects who did not originally respond to the posthypnotic suggestion chose to use the blue pencil when later allowed to complete a questionnaire in private. We found that the mean hypnotizability score (as measured by SHSS:C prior to the suggestion) of subjects who followed the posthypnotic suggestion was 8.5, of those subjects who did not originally follow the posthypnotic suggestion but subsequently chose the blue pencil was 7.1, and of those subjects who were apparently unaffected by the posthypnotic suggestion was 5.9. The same relationship could be shown to hold for SHSS:A and B.

Discussion.

It would seem then that a posthypnotic suggestion which is not

carried out may nonetheless lead to an action tendency which, given suitable opportunity to do so, will be discharged. This may take place even though the hypnotist is not present and might have no way of knowing whether the suggestion was carried out.

4. Summary

These formal studies as well as considerable other evidence all indicate that the effectiveness of hypnosis as a technique to control behavior over long periods of time is extremely limited. On the other hand, it is possible to cause highly hypnotizable subjects to carry out specific actions outside of the experimental context and in a situation where the hypnotist apparently has no way of checking on their behavior. Clearly, a posthypnotic suggestion is different in kind from a waking request. The subject's response to a posthypnotic suggestion appears to satisfy a need within himself that no longer is dependent upon the ongoing relationship with the hypnotist. Though hypnosis, when compared with a waking request, is relatively inefficient as a means of controlling behavior, it does present the possibility of causing individuals to perform actions at some future time even under circumstances where the subject may believe that the hypnotist can in no way know what he actually did. Though this possibility exists, it should be emphasized that, except with very unusual individuals, hypnosis would be an unreliable procedure and it would be difficult to predict with any certainty how long a posthypnotic suggestion would last and whether it would actually be carried out.

C. MOTIVATION AND HYPNOSIS

The behavior of a hypnotized subject has often been conceptualized in terms of motivation. Motivational accounts of hypnosis may take three forms.

(a) Some theorists have described the hypnotized subject as being highly motivated to please the hypnotist (a formulation sometimes erroneously equated with the concept of demand characteristics), or to play the role of a hypnotized subject. Several of our published studies have led us to reject this view. Even so, we have continued to stress that the motivation of the subject may be an important determinant of behavior (see, for example, the studies by Damaser, 1964, and Orne, Sheehan, & Evans, 1968, on posthypnotic behavior; the studies by Orne & Evans, 1966; Evans & Orne, 1971, on the effects of an inadvertent termination of hypnosis; and the studies on punctuality summarized below).

(b) The exaggerated claims of physical and mental performance during hypnosis stem in part from the alleged ease with which the hypnotist can manipulate the motivation of the hypnotized subject to transcend his volitional performance. Our attention to such claims has been limited to methodological studies--the simulation quasi-control design is the most appropriate technique to evaluate the limits of motivated waking performance--and negative studies necessary to determine those hypnotic effects which might be genuine. Our study (Orne & Evans, 1963) on antisocial behavior during hypnosis, and the

recent work rejecting claims that optokinetic nystagmus may provide an invariant criterion of hypnotically induced hallucinations (Graham, 1970c, and Evans, Reich, & Orne, in preparation) provide examples. Orne has critically reviewed those studies claiming hypnotic transcendence of normal capacity (Orne, 1967b).

(c) Hypnosis (and the suggestions administered during hypnosis) may lead to an increase in motivation which in turn may improve performance. Methodological problems make it difficult to find increments in behavior following the induction of hypnosis. What constitutes the relevant waking baseline against which to evaluate hypnotic performance? This in turn raises questions about the adequacy of alternative methodological paradigms. Indeed, the approach of some investigators has led them, inappropriately according to our own empirical work, to reject the term of "hypnosis" as an unnecessary and tautological concept.

1. Performance Changes During Hypnosis

The most appropriate method to investigate performance changes during hypnosis appears to be the ingenious design introduced by London and Fuhrer (1961). A large number of subjects are given an initial test of susceptibility to hypnosis. The extreme responders and non-responders are selected for furthur participation. An attempt is made to motivate insusceptible subjects by convincing them that they are sufficiently deeply hypnotized for the special purposes of the experiment. This is done by capitalizing on whatever subjective

experiences they may have had in their earlier hypnosis session, e.g. relaxation, simple ideomotor suggestion. In a subsequent session a new experimenter may not be able to tell which subjects are high and which are low unless he includes special tests of hypnotic depth. The effect of hypnosis can be studied, not by altering instructions as in previous studies, but rather by comparing susceptible and insusceptible subjects. If an effect is due to hypnosis, a differential response should emerge between the two preselected subject populations.

Using a variety of performance tasks, including dynamometer strength of grip, an endurance task, sensorimotor coordination, and learning nonsense syllables, several studies (London & Fuhrer, 1961; Rosenhan & London, 1963a, 1963b) have shown that the baseline performance of the insusceptible subjects is significantly higher than that of the susceptible individuals. Further, whatever increment in performance may be achieved through the use of hypnotic suggestion will be as great, or greater, in insusceptible subjects as in highly susceptible subjects. One of our earlier studies (Evans & Orne, 1965) failed to confirm these results. Using identical procedures, we found no differences in the performance of high, medium, and low susceptible subjects either before entering hypnosis, or after hypnosis had been induced. Even though the results of several similar studies have been inconsistent, none of the findings in these studies supports the hypothesis that the hypnotized group was more motivated to comply with the wishes of the hypnotist.

2. Subjective Conviction and Performance During Hypnosis

In general, the results summarized above seemed to contradict a large body of previous experimental studies, commencing with Hull (1933), and clinical observations that hypnosis does appear to increase performance under some conditions. The ambiguous findings in our replication of Rosenhan and London's work may be ascribed to a number of factors.

The procedures used were designed to appeal equally well to the nonhypnotized individual. It appeared to us that if we hoped to find an effect of hypnosis on performance, instructions would need to be designed which would utilize the hypnotic phenomenon in producing an effect. Further, some confusion is introduced in the Rosenhan and London study (1963a, 1963b) by using preselected good and poor hypnotic subjects. The experimental model is ingenious but it depends upon the fact that hypnotizability is a reasonably stable attribute of the individual. If a group of subjects are run repeatedly, they do rapidly reach a plateau of hypnotizability: a single test is not sufficient to establish such a plateau. The crucial question, whether the individual is, in fact, able to experience hypnotic phenomena during the particular experimental run, is not adequately tested if subjects are used whose hypnotizability is assessed on a single previous evaluation. Under these circumstances, it is entirely possible that some "good subjects" will fail to enter hypnosis the second time and some "poor subjects" will become

sufficiently hypnotizable to do so. This type of methodological problem would tend to obscure effects due to hypnosis which might actually exist.

To avoid this problem in past research, we have utilized extensive postexperimental inquiries to establish whether the subject had in fact been hypnotized during a particular experiment. This procedure, while in our view eminently useful, has been criticized by colleagues of a strong behavioristic persuasion who have felt that verbal data of this kind is somehow qualitatively different from other behavioral data. It seemed desirable, therefore, to set up the experiment in such a fashion that some behavioral index be obtained of whether the subject would respond to the crucial hypnotic suggestion.

Finally, if we could obtain an increment in performance with hypnotic suggestion in hypnotized individuals, we wished to ascertain how such an increment would be obtained. In experimental work, an increment in performance due to hypnotic suggestion is established by comparing the individual's performance during hypnosis with his performance during a waking control period. An observed change in such a design could be due to an actual increase in hypnotic performance or to a decrease in performance during the waking control period. Previous work in our laboratory has suggested the possibility that apparent increments in performance may, in fact, be achieved by decreasing waking control performance. This type of response is not a conscious, willful deceit by the subject; rather, it is his attempt to comply with the demand characteristics of the total experimental situation.

Procedure.

Subjects who had participated in the study replicating previous work were tested further to establish a more reliable estimate of hypnotizability. Twelve subjects who were very susceptible to hypnosis and twelve subjects who were relatively insusceptible to hypnosis participated in the present experiment. Each subgroup consisted of six male and six female subjects. The subjects were told that the study was an extension of the previous one in which tape-recorded instructions would be used to ensure complete objectivity.

Each subject received four dynamometer strength-of-grip trials, two each in the waking (W) and hypnosis (H) conditions. Half of the subjects in each group were given the trials in the order HWWH, and half were tested in the order WHHW. Time between each trial was kept constant at three minutes. Hypnosis was induced by a previously taught cue.

The hypnosis instructions were designed to induce feelings of increased strength in the dominant hand. Further, a behavioral response was used to assess the presence of this subjective feeling. The subject was asked to flex his fingers to see how strong he felt, and was told that when he felt the increased strength his head would nod.

The taped instructions used for waking and hypnosis testing are reproduced verbatim below.

Waking Instructions. "When I place a small metal object in your hand, I want you to press against it with all your strength. Squeeze

it just as firmly as you can--tight and hard. I want to see how strong you really are. Press it with all your might--. Take the object in your hand now (the experimenter placed the dynamometer in a comfortable position in the subject's hand) and when you are ready, squeeze it as firmly as you can--as tight as you can----. Now!"

Hypnosis Instructions. "Deeply hypnotized--. Pleasantly relaxed, deeply hypnotized. I want to find out how strong you are. A person who is hypnotized can feel ever so strong if he really wants to, --he can feel so much stronger than he is normally--. As you remain deeply hypnotized, you can notice how strong your right hand is becoming--. Your hand is very strong, extremely powerful--. Because you are hypnotized, you are feeling very strong--. You can feel the strength flowing into your hand. It becomes strong and powerful--. Stronger,--stronger,--your hand is incredibly strong--. Just feel that strength and power surging into your hand--. So strong, so powerful, you can lift incredibly heavy weights,--you can grasp things with a vice-like grip. So strong, so powerful--you can feel the extra strength.

Just flex your fingers to see how strong they are----. Your head nods as the strength and power pours into your hand----. Your head nods as your hand feels so very strong, as you feel the added power in your hand. So strong,--so powerful. Your hand is so strong,--strong as steel, and when I test how strong your hand is, it will be stronger than it has ever been before,--so strong, so powerful----." (The waking instructions reported above followed.)

Results.

Effect of Suggested Strength. Mean dynamometer performance for waking and hypnosis trials are presented in Tables 1 and 2. The results for waking base level, and for hypnosis without special suggestion, obtained in the previous experiment, are also presented.

The mean dynamometer scores for waking and hypnosis, for the low susceptible subjects, of 218 lbs. and 217 lbs. respectively, do not differ significantly. However, for the highly susceptible subjects the hypnosis mean of 219 lbs. is significantly larger than the waking mean of 187 lbs. ($p<.005$). The mean increase under hypnosis is 19.2 percent more than waking performance for the hypnotized subjects. If each subject's hypnosis increase is expressed as a percentage of initial waking performance in this session, then the average increase of the high group is 31.4 percent compared to the decrease of 0.2 percent for the low subjects ($p<.001$, Mann-Whitney U-test).

Increased Performance and Subjective Experience. The study was designed to elicit the subject's subjective experience of the suggestion as well as his overt performance. In general, increases in performance were closely associated with head-nodding in both groups. The hypnosis scores of the two insusceptible subjects who nodded acceptance of the suggestion were 17 and 14 percent greater than their respective waking performances. The changes in performance of the non-nodding insusceptible subjects were smaller. Of the 12 highly susceptible subjects, 10 both nodded that they experienced the feelings

Table 1

Dynamometer mean scores, with and without instructions of increased strength during hypnosis.

Hypnotizability		Performance				Order	Suggestion and Performance			
Sample	Suscept.	W1	W2	H1	H2		W1	W2	H1	H2
R & L Replication (4 male & 2 female per group)	Low	175	168	190	143	HWWH	223	222	213	232
		232	182	223	178	WHHW	220	195	233	190
	High	160	132	115	110	HWWH	158	155	208	198
		210	165	167	155	WHHW	225	207	235	235
First Replication (6 males per group)	Low	288	295			HWWH	263	273	284	262
		298	305			WHHW	305	289	306	291
	High	237	261			HWWH	242	256	248	252
		239	247			WHHW	239	223	262	238
Barber Imagination (6 males per group)	Low	287	306			IWWI	300	299	303	308
		279	306			WIIW	299	291	263	317
	High	247	267			IWWI	243	288	285	286
		286	302			WIIW	312	263	316	309
Second Replication (6 males per group)	Low					HWWH	276	263	284	260
	High					HWWH	226	241	296	272

Table 2

Summary of dynamometer means with and without special strength suggestions.

Study	Hypnotizability Group	Pre-level Replication W	Pre-level Replication H	Pre-level Replication H-W/W %	Experimental level (Suggestion under hypnosis) W	Experimental level (Suggestion under hypnosis) H	Experimental level (Suggestion under hypnosis) H-W/W %
Rosenhan-London	Low HWWH	172	167	-4.7	223	223	0.0
	WHHW	207	200	-5.4	213	212	-0.4
	Average	190	183	-5.2	218	217	-0.2
	High HWWH	146	113	-10.8	157	203	29.3
	WHHW	188	161	-28.3	216	235	8.8
	Average	167	137	-20.0	187	219	19.2
First Replication	Low HWWH	307			268	273	1.9
	WHHW	301			297	298	0.3
	Average	304			282	286	1.4
	High HWWH	249			249	250	0.4
	WHHW	243			234	250	6.8
	Average	246			240	250	4.2
Imagination	Low IWWI	297			300	306	2.0
	WIIW	293			295	290	-1.7
	Average	295			297	298	0.3
	High IWWI	257			265	285	7.5
	WIIW	294			287	312	8.7
	Average	275			276	298	8.0
Second Replication	Low HWWH	273			270	272	0.6
	High HWWH	249			234	284	21.3

of strength and showed increased hypnosis performance ranging from 6 percent to 133 percent of waking level.

Head-nodding is significantly associated with whether the subject is susceptible or relatively insusceptible to hypnosis. However, this association was not perfect. If subjects are classified only in terms of head-nodding without reference to their susceptibility to hypnosis, 12 of the 13 subjects who nodded their heads showed an increase in hypnosis performance, averaging 30.9 percent. This was significantly greater than the net decrease of 4 percent for those 11 subjects who did not experience the increased strength. This finding is even more impressive when it is noted that in the previous study the dynamometer scores under hypnosis for these same susceptible subjects (without appropriate accompanying suggestions) were actually 20 percent lower than their (already depressed) waking base level performances. Capitalizing on the quasi-magic of hypnosis, apparent increases in strength were observed in those subjects who were hypnotized deeply enough to experience the suggestions of increased strength.

Change During Hypnosis and Order of Testing. The waking and hypnosis means for the low group and the hypnosis mean of the high group (218, 217, and 219 lbs. respectively) do not differ. However, the waking mean of the susceptible subjects of 187 lbs. is significantly lower than either their own hypnosis mean ($p<.01$) or than the waking mean of the low group ($p=.075$). An examination of mean changes for the two subgroups in terms of the order of receiving the dynamometer

trials further clarifies this relationship. There are no differences between waking or hypnosis means for the low group. The difference between waking and hypnosis means for the highly susceptible subjects (216 and 235 lbs. respectively) for the WHHW testing order is significant ($p<.01$). A similar difference between waking and hypnosis means of 155 lbs. and 203 lbs. for the HWWH test order is also significant ($p=.05$). The relative difference for the WHHW order of only 12.1 percent of waking performance is significantly smaller than for the HWWH order of 50.6 percent ($p=.047$, Mann-Whitney U-test).

The results, then, suggest that the change in strength between waking performance and performance during hypnosis, for which special suggestions of strength have been included, arises not so much because of increased performance under hypnosis, but rather because of depressed waking performance. The depressed waking performance occurs to a greater degree if the waking testing precedes the hypnosis performance.

Discussion.

In this study there has been an apparent improvement in the dynamometer scores of highly susceptible subjects to whom it has been suggested that they are feeling strong. This finding contrasts with the results in earlier studies (Evans & Orne, 1963) reviewed above, which have found no superiority on the part of the susceptible subjects performing during hypnosis compared to their waking base level scores. The important factor in the difference in these results appears to be the

special attempt to utilize hypnotic techniques to induce the subjective conviction of increased strength in the arm. Almost invariably the highly susceptible subjects gave an overt behavioral response, nodding of the head, to indicate that they subjectively experienced the increased feeling of strength. Almost without exception, the insusceptible subjects did not indicate behaviorally that they experienced a similar phenomenon. Thus, in order to obtain results which appear to produce a transcendence of waking levels of performance, it seems necessary to utilize hypnotic phenomena and the quasi-magical aspects of hypnosis to induce such improved performance. If this is done, it is possible to demonstrate by an overt behavioral action that the subject is subjectively convinced that this is the state of affairs, that there has been a successful induction of a distortion in reality for highly susceptible subjects which has produced an apparent increase in strength.

The question whether hypnosis can be used to increase the performance of good hypnotic subjects over and above that which can be obtained by other motivating techniques remains unresolved. The findings of this particular study could be interpreted as demonstrating this to be the case. However, by far the most significant relative increase in performance occurred in the group where the hypnotic test preceded the waking test. Furthermore, the greatest difference in performance in this group appears to occur in their baseline waking performance which followed their hypnotic performance. In line with previous studies, this finding can be seen as a highly complex response to the total situation

where the subject artificially decreases his waking baseline in order to yield better relative performance in the hypnotic state.

Perhaps of even greater interest, though, is what occurs with the subject who is tested first in the waking condition. These subjects show an initial level similar to that of the insusceptible control subjects. However, they still show a significant increase in performance during hypnosis. This increase, while relatively smaller, yields a level of performance which is greater than that of any group in any other condition.

3. Depressed Waking Performance: A Replication

The study described above is important because it conceptually expands the basic London-Fuhrer design. It is our view that hypnosis is a subjective experience, and that changes due to hypnosis cannot be evaluated without first determining whether the suggested effects were actually experienced by the subject. Nevertheless, the study was inconclusive. An important mechanism underlying the apparent improvement in strength in hypnotized subjects was a situationally determined tendency to "hold back" waking performance in order to "protect" the validity and integrity of the subjects' hypnotic performance. However, when such a holding-back effect was not likely because the counterbalancing limited such a response, small but statistically insignificant improvements in performance were observed in the susceptible group.

We decided to replicate the study to determine whether both of these factors could be demonstrated. An additional group of high and

low susceptible subjects were included. Each subject had taken part in several hypnosis sessions. We have been puzzled by the consistent failure of the voluminous work by Dr. Barber to show differences in performance between hypnotized subjects and subjects given his special task motivation instructions. While his choice of subjects who are unselected for hypnotizability accounts for many of his negative results, we wished to examine the effects of his task motivation instructions when they were used with experienced subjects who were quite familiar with the hypnotic research program.

Procedure.

The procedure was identical to that described above. These subjects did not receive the London-Fuhrer replication initial session, but a waking dynamometer trial was administered using similar instructions. A similar waking trial was given informally at the end of the experiment. The 24 high and low susceptible male subjects were randomly assigned to hypnosis or task-motivation (imagination) conditions. Instructions were tape recorded, and the same suggestions of increased strength, indicated by head-nodding, were used. Instead of standard induction of hypnosis, the imagination group was given the following instructions, provided by Dr. Barber:

"In this experiment I'm going to test your ability to imagine and to visualize. How well you do on the tests which I will give you depends entirely upon your willingness to try to imagine and visualize the things I will ask you to imagine. Everyone passed these tests when they tried.

For example, we asked people to close their eyes and to imagine that they were at a movie theater and were watching a show. Most people were able to do this very well; they were able to imagine very vividly that they were at a movie and they felt as if they were actually looking at the picture. However, a few people thought that this was an awkward or silly thing to do and did not try to imagine and failed the test. Yet when these people later realized that it wasn't hard to imagine, they were able to visualize the movie picture and they felt as if the imagined movie was as vivid and as real as an actual movie.

What I ask is your cooperation in helping this experiment by trying to imagine vividly what I describe to you. I want you to score as high as you can because we're trying to measure the maximum ability of people to imagine. If you don't try to the best of your ability, this experiment will be worthless and I'll tend to feel silly. On the other hand, if you try to imagine to the best of your ability, you can easily imagine and do the interesting things I tell you and you will be helping this experiment and not wasting any time."

Results.

The results are summarized in the lower portions of Tables 1 and 2. The main findings for the hypnosis and imagination conditions will be discussed.

Hypnosis Condition. (a) The basic findings reported initially by London and Fuhrer (1961), and Rosenhan and London (1963) were confirmed. Insusceptible subjects had significantly higher waking

performances than susceptible subjects, both during the experiment proper and during the informal pre- and post-experimental trials. (b) The mean performance during hypnosis of the hypnotizable subjects of 250 lbs. was not significantly different from their waking performance of 240 lbs., or from their informal waking trials of 244 lbs. (c) For hypnotizable subjects, the performance increase during hypnosis was an insignificant 4.0 percent compared to the significant 19.2 percent increase in the original study. (d) No evidence of an order effect similar to that found in the previous study was apparent. In the HWWH order, the respective hypnosis and waking means were 250 lbs. and 249 lbs. The apparent holding back of waking performance was not observed in this study. (e) In the earlier study, we were particularly intrigued by the increase in performance of the hypnotizable subjects tested in the WHHW order where no order effect of the "holding-back" type could occur. The insignificant hypnosis condition increase of 8.8 percent is comparable to the insignificant 6.8 percent increase in the replication study. (f) Unlike the original study, the correlation between head-nodding and the incidence of increased performance was insignificant. The meaning of this result is unclear in the absence of marked improvement in any of the hypnotized subjects.

Imagination Condition. (a) Performance during the imagination condition was consistently and significantly higher than for the hypnosis condition ($p < .05$). (b) An order effect tended to occur in the IWWI condition similar to that found in the HWWH order in our original hypnosis

experiment. (c) Both high and low subjects perceived the imagination instructions as an alternative technique, devised elsewhere, to induce hypnosis. They rated themselves as deeply hypnotized as they usually were when they had been hypnotized using the conventional induction methods (of this laboratory). While this was an interesting, if not predictable, result, caution should be exercised in generalizing inappropriately to Barber's situation involving inexperienced subjects who may not know explicitly that hypnosis is being used with other subjects. Nevertheless, the result provides some insight into possible mechanisms whereby Dr. Barber frequently reports no differences between task motivating and hypnosis instructions.

Summary.

We have no meaningful hypothesis about our failure to replicate the original findings.

A second attempt was made to replicate the portions of the experiment related to the original order effect findings. Using the same procedures, with a different experimenter, an additional 6 susceptible and 6 insusceptible male subjects were tested. In an attempt to confirm the existence of a "holding-back" order effect, the procedures were confined to the HWWH order of testing. The results are summarized at the bottom of Tables 1 and 2. Clearly, the original findings were replicated in the susceptible subjects. The waking and hypnosis means of the insusceptible subjects (270 and 272 lbs., respectively) do not differ significantly from the susceptible subjects' hypnosis mean of

284 lbs. However, the waking performance of the susceptible subjects (234 lbs.) is significantly lower. The difference between the waking and hypnosis performances of 21.3 percent does not differ significantly from the relative difference of 29.3 percent in the original study.

Unfortunately, a confusing picture remains. In the three hypnosis studies, as well as in the task motivation group, the relative increase in strength of grip during hypnosis is greater for those deeply hypnotized subjects who nod their heads indicating they successfully experienced the suggestion than for those insusceptible subjects who did not experience the suggestion successfully. However, the differences tend not to reach statistical significance. If the quasi-magical suggestions of strength lead to increased performance, some, if not all of the change may have been more apparent than real. Susceptible subjects appear to depress waking performance rather than increase hypnotic performance, presumably to "protect" the integrity of their own hypnotic experiences. Whatever changes in motivation may be occurring in conjunction with these suggestions may be determined by situational factors rather than by hypnosis.

At this stage in the research program we decided to abandon the present task. Whatever increments in strength could be attributed to techniques designed to maximize subjective involvement seemed, at best, small. At least as measured by the kinds of performance tasks we have used, hypnotic suggestion appears to be no more effective in motivating subjects to perform maximally than a variety of alternative convincing

manipulations. The research strategy, however, seemed an appropriate one: to maximize waking performance using a modified London-Fuhrer design as a baseline for evaluating hypnotic changes in those hypnotizable subjects who experience the suggested effects. This strategy was successfully applied in our published study of hypnotic analgesia (McGlashan, Evans, & Orne, 1969), described below.

4. Punctuality for Experiments, Motivation and Hypnosis

The studies summarized so far are concerned with the motivational effects of being hypnotized, or of being given specific hypnotic suggestions of altered performance. We have been investigating an unobtrusive variable which, over the course of our work, seemed associated with hypnotizability, but which could not be accounted for in terms of the high motivation to be pleasing to the experimenter.

Procedure.

Routinely subjects are scheduled for specific appointments at the laboratory. When the subjects arrive, they are greeted by a receptionist who unobtrusively notes arrival time in relation to their appointment time.

Results.

Insusceptible subjects tend to come early for their appointments, susceptible subjects tend to come late. These differences in punctuality have been significant in several samples. In addition, those subjects who are susceptible to hypnosis are more likely not to show up for their appointments.

Discussion.

While this observation can be interpreted in several interesting ways, none of the explanations can be couched in motivational terms. Tardiness and failing to appear are not in accord with conceptions of "trying hard to please" and ccoperation. The lateness is not a specific function of hypnosis, as in some samples punctuality was observed in studies having nothing to do with hypnosis. Even during independent studies, those subjects who occasionally arrive late tend to be more hypnotizable when they take part in hypnosis experiments several months later.

5. Summary

As we have concluded in several reports, motivational concepts do not seem to be particularly useful explanatory concepts for an understanding of hypnosis. Hypnosis appears to be a relatively inefficient way of controlling behavior and motivating people. This does not mean that motivational factors are not important determinants of behavior: high levels of motivation characterize experimental subjects in any situation, not merely hypnosis. Hypnosis does not seem to add to these motivational levels, nor is there any evidence that hypnotizable subjects are somehow specially motivated to perform well.

D. HYPNOSIS AND REDUCTION OF PAIN

The ability of hypnosis to alleviate physical pain by hypnotic suggestion is not only of considerable theoretical interest but has major practical implications. In spite of the clinical reports of the uses of hypnotically induced anesthesia and analgesia in dentistry, obstetrics, surgery, and in the control of intractable terminal cancer, the bulk of experimental studies have been unsuccessful in demonstrating the effectiveness of hypnosis as a pain reducing agent. Several reasons seem to have been involved in this failure. First, the types of pain stimuli employed in experimental studies are usually transient and different in kind from the longer lasting quality of clinical pain. In this regard, the difficulty in demonstrating experimentally the effectiveness of hypnosis as an analgesic closely parallels the failure until quite recently to prove in the laboratory that morphine was more effective than placebo. Second, changes in the pain experience are closely related to changes in anxiety. Laboratory studies have typically minimized anxiety as a variable and in so doing may have inadvertently minimized one of the important mechanisms by which hypnosis is effective. Third, as in the studies on motivation and performance during hypnosis, the evaluation of hypnotically induced pain relief can be made only in light of the subjective effectiveness of the hypnotic analgesia suggestions.

A study carried out under our contract utilized an ischemic pain task. This method of inducing pain produces results which are sufficiently similar to clinical pain: for example, morphine effectively reduces its intensity differentially from placebo (Smith, Egbert, Markowitz, Mosteller, & Beecher, 1966). Further, the procedure itself had anxiety inducing qualities (Evans & McGlashan, 1967). Finally, the experimental work was so designed that the reduction in the pain experience during hypnosis would be reflected in the subjective experience of the hypnotized individual. Thus, both objective and subjective measures of the effectiveness of hypnotic analgesic suggestions were utilized. The substantive study has been published (McGlashan, Evans, & Orne, 1969) and is only summarized here.

Procedure.

The effect of hypnotically induced analgesia was compared with the placebo response to a "powerful analgesic drug." Highly motivated subjects who were known to be either very susceptible (N = 12) or relatively insusceptible (N = 12) to hypnosis performed a task which induced ischemic muscle pain.

Special procedures were adopted to establish plausible expectations in both groups that the two treatments could effectively reduce pain. An attempt was made to convince insusceptible subjects that they would be able to experience hypnotic analgesia. All subjects were told that the "pain-killing drug" which they ingested would produce the maximum pain relief possible so that the effects of hypnotic analgesia could be evaluated meaningfully. Although all subjects received placebo, the experimenter believed that half of them had received an active drug under the usual double-blind conditions.

Results.

Significant overall changes in pain threshold (45 percent) and tolerance (25 percent) following hypnotic analgesia were found. Under placebo conditions, pain threshold and tolerance were increased 53 percent and 10 percent respectively. Pain reduction was similar for susceptible subjects following placebo and for insusceptible subjects following both hypnosis and placebo. As expected, the placebo response was uncorrelated with hypnotic susceptibility. Pain relief exceeding that produced by the placebo response occurred during hypnotic analgesia only for those highly susceptible subjects who subjectively rated the pain as significantly decreased during hypnotic analgesia. For those deeply hypnotized subjects who were subjectively convinced that the analgesia worked for them, the increase in pain tolerance was three and a half times as great as the relief for those unconvinced hypnotized subjects who, nevertheless, responded as significantly as all subjects responded to the placebo trial (about 10 percent). The correlation between the subjective pain ratings following the hypnosis and placebo conditions was high (.76) for insusceptible subjects but insignificant (.06) for susceptible subjects. The correlation between the pain ratings and objective performance during hypnosis, however, was high (.65) for susceptible subjects but insignificant (-.11) for insusceptible subjects.

The results support the hypothesis that there are two components involved in hypnotic analgesia. One component can be accounted for by the nonspecific or placebo effects of using hypnosis as a method of treatment; the other may be conceptualized as a distortion of perception, possibly related to negative hallucinations, specifically induced during deep hypnosis.

Discussion.

These results have two major implications for an understanding of hypnosis.

First, all subjects responded by increasing their tolerance for severe pain in an experimental situation that had medical overtones which helped create a plausible situation where changes could be legitimized. Both hypnotically susceptible and insusceptible subjects responded to a placebo and responded in a like manner to hypnosis. By referring to the placebo components of hypnosis we refer to all of those factors, situationally and expectationally determined, which lead to changes in the hypnotic context which have nothing to do with the hypnotic process. These nonspecific factors in the hypnotic situation probably account for such diverse findings as the paradoxical performance improvements of insusceptible subjects in the London-Fuhrer design, our recent observation that neighboring subjects, independently of susceptibility level, score more alike than non-neighbors during group administered hypnosis scales, and the clinically observed lack of correlation between depth of hypnosis and clinical effectiveness.

Second, we have convincingly demonstrated that failure to consider the subjective experience of the specific suggestion (of analgesia) would have obscured dramatic pain relief in those few hypnotized subjects who had the contingent subjective experience. Changes in performance can be evaluated properly by investigating such changes in terms of the presence or absence of the appropriate (suggested) subjective experience. It would be inappropriate, for example, to ask questions about hypnotic hallucinations unless the subject indicated he was experiencing a subjectively real hallucination.

Our findings lead to the conclusion that hypnotically induced analgesia will be an effective means of reducing pain even in those individuals who are not highly responsive to hypnosis. In addition to the very considerable relief which all individuals can experience in this fashion, those individuals who are capable of experiencing hypnosis will have an even greater increase in tolerance of pain.

In addition to the very real practical implications of this major study, the theoretical implications may be of even greater importance. Contrary to the widely held belief, the placebo component of hypnosis is essentially uncorrelated with hypnotizability. The lack of correlation between placebo responsivity, suggestibility, and hypnotizability (Evans, 1970) causes us to reëvaluate our concept of hypnosis in relation to suggestion and persuasive communication, issues which will be discussed further in the final section of this report.

E. PSYCHOPHYSIOLOGICAL CORRELATES OF HYPNOSIS

We have carried out several investigations concerned with the psychophysiological correlates of, and changes during, hypnosis. Despite their early promise, these studies have produced essentially negative results, and no physiological response uniquely associated with hypnosis has been identified. Our studies have focused on two physiological variables: the electrodermal response, specifically skin potential (SP) and electroencephalographic (EEG) alpha activity.

Our earlier reports (O'Connell & Orne, 1962, 1968) which indicated that SP changes might provide an index of hypnotic depth warranted further investigation. Because of the long association between hypnosis and sleep, the relationship between the EEG and hypnosis has a long history. Alpha activity (7-13 Hz) is closely associated with relaxation and the transitional stages of sleep, and claims have been made that alpha density (London, Hart,& Leibowitz, 1968; Engstrom, 1970), or amplitude (Brady & Rosner, 1966), are related to hypnosis. The recent interest in feedback control of alpha (Kamiya, 1969) has led to renewed interest in this topic.

1. Skin Potential Changes and Hypnosis

Changes in the level of SP were found to be associated with the induction of hypnosis (O'Connell & Orne, 1962). Initially, it was hoped that a psychophysiological correlate of hypnosis had been discovered. Subsequent analysis (O'Connell & Orne, 1968) indicated that the extent of the change was not related to the depth of hypnosis achieved

but rather was a response to the induction procedure as such.

Of particular interest was the observation that there were differences between the basal level of SP of subjects who were able to enter deep hypnosis readily and those who were less able to do so. Indeed, these differences accounted for what had once appeared to have been a correlation between SP change and hypnosis. In our earlier observations the number of times subjects had been to the laboratory was not controlled, and it is entirely possible that factors such as rapport might have accounted for some of the observed differences. The present study (Evans, 1970) was designed to yield data about subjects in three ranges of hypnotizability--high, medium, and low--who were essentially equated for the amount of contact with the laboratory.

Of equal importance and interest has been the question of what is meant by hypnotic depth. From the hypnotist's point of view, depth of hypnosis refers to the extent to which the subject is able to respond to suggestions of increasing difficulty. This definition of hypnotic depth, while closely congruent with the concept of hypnosis as commonly used, does not correlate perfectly with the subject's subjective estimate of hypnotic depth. Changes in SP might more accurately mirror the changes in the subject's experience of being hypnotized within a session than some objective behavioral measure. For this reason, a technique was devised which would yield ongoing estimates of subjective depth (SDE) which could then be correlated with changes in SP.

Procedure.

College student volunteers completed the tape-recorded Harvard Group Scale of Hypnotic Susceptibility (HGSHS:A) of Shor and E. Orne (1962). From the 102 subjects tested, 3 groups of 20 subjects (12 male) were invited back to participate in further hypnosis research. The high susceptible subjects scored 8 or above on HGSHS:A, medium subjects scored 5, 6, or 7, and the low or insusceptible subjects scored 4 or less on the 12-point scale.

Two individual sessions were conducted, each involving hypnosis. The subjects were taught a standard induction procedure, and were well acclimated to the laboratory procedures being used. The same experimenter tested all subjects. At the end of the final session SHSS:C was administered.

An Offner Type RS two-channel dynograph was used to record SP, with a paper speed of 1 cm/min and a gain of 10 mv/cm. Silver-silver chloride sponge electrodes were placed on the thenar eminence of the right palm and the dorsal aspect of the right forearm.

Subjects were asked to continuously indicate their subjective judgment of depth of hypnosis while hypnotized, using a clock face scale from 1 (normal alert) to 10 (as deeply hypnotized as any person can become). The ratings (SDE) were indicated by moving a hand of the clock, and were recorded on the polygraph record. Both SP and SDE records were scored by two independent judges. The data analysis was primarily concerned with similar waking and hypnosis two-minute eyes-closed rest periods.

Results.

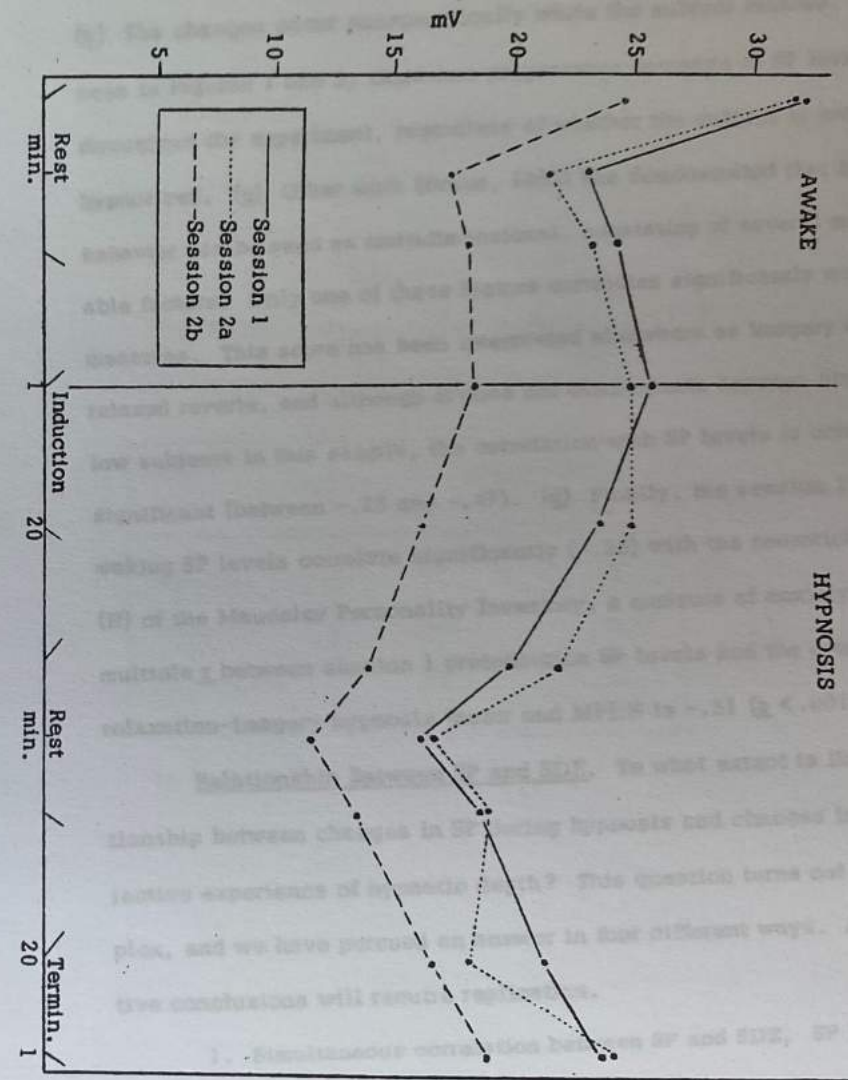
Changes in SP Following Induction. Figure 1 presents SP levels for each of the three recording segments. Waking and hypnosis measures are presented for all 60 subjects. Dramatic and highly significant decreases in the ongoing level of SP were observed during hypnosis ($p < .001$ for all comparisons). However, these changes do not appear to be a simple function of hypnosis. None of the 17 separate waking-rest SP measures correlate significantly with HGSHS:A or SHSS:C scores. None of the 14 measures of SP base level changes during hypnosis correlate with the measures of hypnotic depth.

SP Changes in the Insusceptible. The relationship between SP and hypnotic susceptibility is depicted in Figure 2. Data for high and low susceptible subjects are presented for both sessions. There are no initial waking baseline SP differences between high and low subjects. Both high and low susceptible subjects show similar significant changes in SP level during hypnosis. While the hypnosis rest period is significantly lower than an "aroused" waking baseline for both groups, it appears that the high subjects do not become significantly more relaxed during hypnosis than either they or the low subjects can become while awake.

In summary, SP levels decrease during hypnosis in the direction of lowered arousal, but these changes occur to at least an equal degree in insusceptible subjects. Thus, it appears unlikely that SP can serve as an indication of hypnosis.

Figure 1.

Skin potential changes during hypnosis for three sessions (N=60).



Mediating SP Change. The SP changes are probably a function of both physical relaxation and the relaxation that comes about as the subject becomes more comfortable with the total experimental situation. (a) The changes occur nonspecifically while the subject relaxes. (b) As seen in Figures 1 and 2, there is a progressive decrease in SP levels throughout the experiment, regardless of whether the subject is awake or hypnotized. (c) Other work (Evans, 1965) has demonstrated that hypnotic behavior can be seen as multidimensional, consisting of several measurable factors. Only one of these factors correlates significantly with SP measures. This score has been interpreted elsewhere as imagery or relaxed reverie, and although it does not discriminate between high and low subjects in this sample, the correlation with SP levels is consistently significant (between -.25 and -.47). (d) Finally, the session 1 elevated waking SP levels correlate significantly (-.35) with the neuroticism scale (N) of the Maudsley Personality Inventory, a measure of anxiety. The multiple r between session 1 preinduction SP levels and the combined relaxation-imagery hypnosis factor and MPI:N is -.51 ($p < .001$).

Relationship Between SP and SDE. To what extent is there a relationship between changes in SP during hypnosis and changes in the subjective experience of hypnotic depth? This question turns out to be complex, and we have pursued an answer in four different ways. Any definitive conclusions will require replication.

1. Simultaneous correlation between SP and SDE. SP level and SDE rating were simultaneously measured at 75 different data points

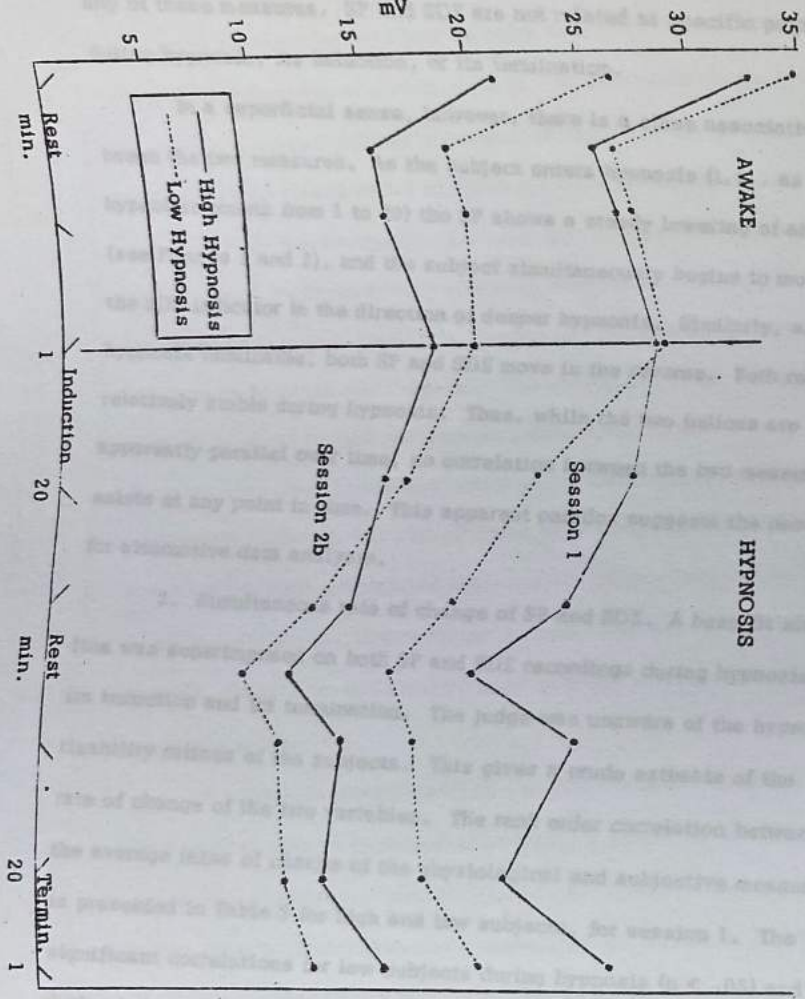


Figure 2. Skin potential changes for Ss of high and low hypnotizability

during the two sessions. No significant correlations were found between any of these measures. SP and SDE are not related at specific points during hypnosis, its induction, or its termination.

In a superficial sense, however, there is a close association between the two measures. As the subject enters hypnosis (i.e., as the hypnotist counts from 1 to 20) the SP shows a steady lowering of arousal (see Figures 1 and 2), and the subject simultaneously begins to move the SDE indicator in the direction of deeper hypnosis. Similarly, as hypnosis terminates, both SP and SDE move in the reverse. Both remain relatively stable during hypnosis. Thus, while the two indices are apparently parallel over time, no correlation between the two measures exists at any point in time. This apparent paradox suggests the need for alternative data analysis.

2. *Simultaneous rate of change of SP and SDE.* A best-fit straight line was superimposed on both SP and SDE recordings during hypnosis, its induction and its termination. The judge was unaware of the hypnotizability ratings of the subjects. This gives a crude estimate of the rate of change of the two variables. The rank order correlation between the average rates of change of the physiological and subjective measures is presented in Table 3 for high and low subjects, for session 1. The significant correlations for low subjects during hypnosis ($p < .05$) and during induction ($p < .10$) suggest that the physiological change and subjective experiences may be interrelated for insusceptible subjects, but not for hypnotizable ones.

Table 3

Correlations between rate of change of SP and rate of change of SDE ($N = 20$ per group).

Phase	Hypnotizability	
	High	Low
Induction	.02	.29
Hypnosis	-.08	.39*
Termination	.13	.14

*$p < .05$

3. Correlations between SP and SDE for individual subjects. A time lag could conceivably occur between the physiological response and subjective experience of changing depth. At each point during hypnosis at which the subject initiated movement on the SDE, any maximum SP deflection was scored which occurred within a 15-second period either before or after the movement. For each high and low subject separately, a correlation coefficient was calculated between SDE magnitude and proximal SP change. There is a significant relationship between SDE and SP for both high and low subjects. The selection of high subjects can be defined in terms of their subsequent performance on SHSS:C--some subjects do not subsequently maintain a high score. There is a significant relationship between SDE and proximal SP shift for insusceptible subjects and for those high susceptible subjects who obtain only moderate scores on SHSS:C (Table 4). However, for subjects who are consistently susceptible, there is no such relationship between psychophysiology and subjective state.

4. Temporal sequence of SP and SDE changes. Which comes first--physiological change or change of subjective state? In an attempt to answer this question we tabulated for each increase or decrease in subjective state whether there was a corresponding change in SP during the 15-second periods before or after the onset of the SDE change. The results are summarized in Table 5. Each row summarizes one cell of a 2 x 2 chi square table, in which all responses are tabulated across all subjects. The two significant results imply the following: (a) There is

Table 4

Mean correlations between subjective depth estimates of hypnosis and proximal SP baseline shift.[a]

Susceptibility		N	r	p
HGSHS:A	SHSS:C			
High	High	10	-.08	n.s.
High	Medium	10	-.41	< .001
Low	Low	20	-.22	< .001

a. A correlation was computed for each individual between SDE change and any SP change within 15 seconds of SDE change.

Table 5

Temporal sequence of SP and SDE changes

Group	Direction of change If:	Then:	p
High	SDE +	SP -	= .10
Low	SDE +	SP -	< .005
High	SP -	SDE +	< .05
Low	SP -	SDE +	> .20

a significant tendency for the insusceptible subjects to report an altered subjective state which is followed by a consequent change in SP in the same (consistent) direction, i.e., the low subject reports feeling more hypnotized, and only then does he relax physiologically. (b) Highly susceptible subjects, however, indicate a subjective change in depth of hypnosis in response to a physiological change (in SP) that has already occurred.

Summary.

The relationship between the concurrent changes in SP during hypnosis and in subjectively reported depth of hypnosis have been analyzed in several ways. One reasonably consistent conclusion emerges which has considerable theoretical interest. A relationship seems to exist for insusceptible and even moderately susceptible subjects between subjective report of hypnotic depth and shift in SP level. For insusceptible subjects, when allowance is made for an appropriate time lag, a change in subjective state is not only accompanied by a proximal SP change, but seems to precede it in most instances. The relationship may not hold for highly susceptible subjects who have reached a plateau hypnosis level. The good subject may change his subjective state as a result of a preceding physiological change, or the two variables may change independently. The physiological changes that do occur (and such changes are very pronounced) are probably a function of relaxation, and certainly do not reflect depth of hypnosis.

2. SP with Hypnotized and Simulating Subjects

Further convincing evidence that SP changes cannot serve as indicators of hypnosis is provided by two attempts to differentiate between hypnotized and simulating subjects. In the studies of the effects on hypnosis of a power failure, and the consequent disappearance of the hypnotist for 40 minutes, SP was recorded continuously throughout the session. In the first of these studies (Orne & Evans, 1966) several blind judges attempted to select the hypnotized and simulating subjects by examining waking and hypnosis segments of the SP record. In the second study (Evans & Orne, 1971) SP base levels of hypnotized and simulating subjects were measured at several points, both before and during the power failure.

Detection of Simulating Subjects by Blind Judges.

Procedure. The procedure for the two sessions of the experiment has been described elsewhere (Orne & Evans, 1966; Evans & Orne, 1971). Hypnosis was regularly induced with a tape recorder and the experimenter was present only as an observer. Several standard hypnotic phenomena were induced in each session. Continuous measures of SP were recorded at a speed of 25 mm/sec on a two-channel Offner Polygraph, using procedures described elsewhere (O'Connell & Orne, 1962, 1968). The simulators were told that a blind experimenter would be able to use the physiological data to help decide if they were simulating, although they were told that no completely reliable physiological index of hypnosis had been discovered as yet.

A two-minute rest segment, preceded and followed by an induction and termination of hypnosis, in all lasting about 5 minutes, was selected. The records for 12 subjects (6 hypnotized and 6 simulators) were randomly placed on a long table. Five judges were asked to try to select the six records obtained from the hypnotized subjects and the six from those simulating. They were encouraged to base their judgments on any aspect of the record they chose, and were allowed to make decisions in any order they wished, taking as long as they required. All records were available to the judges at the same time.

All 5 judges were well acquainted with previous research in the laboratory attempting to relate SP to susceptibility to hypnosis, and were familiar with the experimental procedure, as well as which segment of the procedure had been chosen for the present study. Three of the judges were experienced in working with hypnosis, but had different amounts of experience with psychophysiological recording techniques. Two of the judges were technicians who had been trained to record psychophysiological measures, but had no formal training in psychophysiology or related fields.

Results. The ratings for each judge are presented in Table 6. There is no evidence that the judges could discriminate between the SP records produced by real and simulating subjects. Ironically, the two technicians were able to discriminate slightly better than the three experienced judges, but the individual contingency tables do not reach statistical significance.

Table 6

Blind ratings attempting to discriminate GSP records of hypnotized and simulating subjects

	E1		E2		E3		T1		T2		Majority[a] 3 of 5	
	Hyp.	Sim.	Hyp.	Sim.	Hyp.	Sim.	Hyp.	Sim.	Hyp.	Sim.	Hyp.	Sim.
Judgment:	3	3	3	3	3	3	4	2	4	2	4	1
Hypnotized Simulator:	3	3	3	3	3	3	2	4	2	4	2	5

Note: $\underline{N}$ = 6 Hypnotized (Hyp.) and $\underline{N}$ = 6 Simulator (Sim.). No comparison is significant. Es are experienced investigators; Ts are technicians.

a. Indicates that at least 3 judges agreed on subject's identity.

With five judges, a majority opinion had to be reached about each subject. To what extent could a majority vote lead to successful discrimination of the real and simulating subjects? These results are presented in Table 6. Although five of the simulators and four of the hypnotized subjects were correctly identified by the majority of judges, the discrimination is not statistically significant. The results seem encouraging, but it should be noted that pooling ratings in this manner capitalizes on chance to an unknown degree.

It is concluded that there is no adequate evidence supporting the possibility that resting SP during hypnosis differs between deeply hypnotized subjects and insusceptible subjects who are successfully simulating hypnosis. Any such differences that may exist cannot be successfully and reliably detected by experienced judges attempting to make such discriminations on a blind basis.

SP in Hypnotized and Simulating Subjects.

In the later study (Evans & Orne, 1971) SP was recorded throughout the session during which the power failure occurred. Figure 3 shows SP levels at several points during this session.

In general, the base level shifts in SP during hypnosis tend to be similar to those reported above. Initial waking levels were low for both groups of subjects--no doubt a function of the fact that subjects were used to the psychophysiological procedures which had been used in at least two previous sessions.

Analyses of variance were conducted on the data depicted in

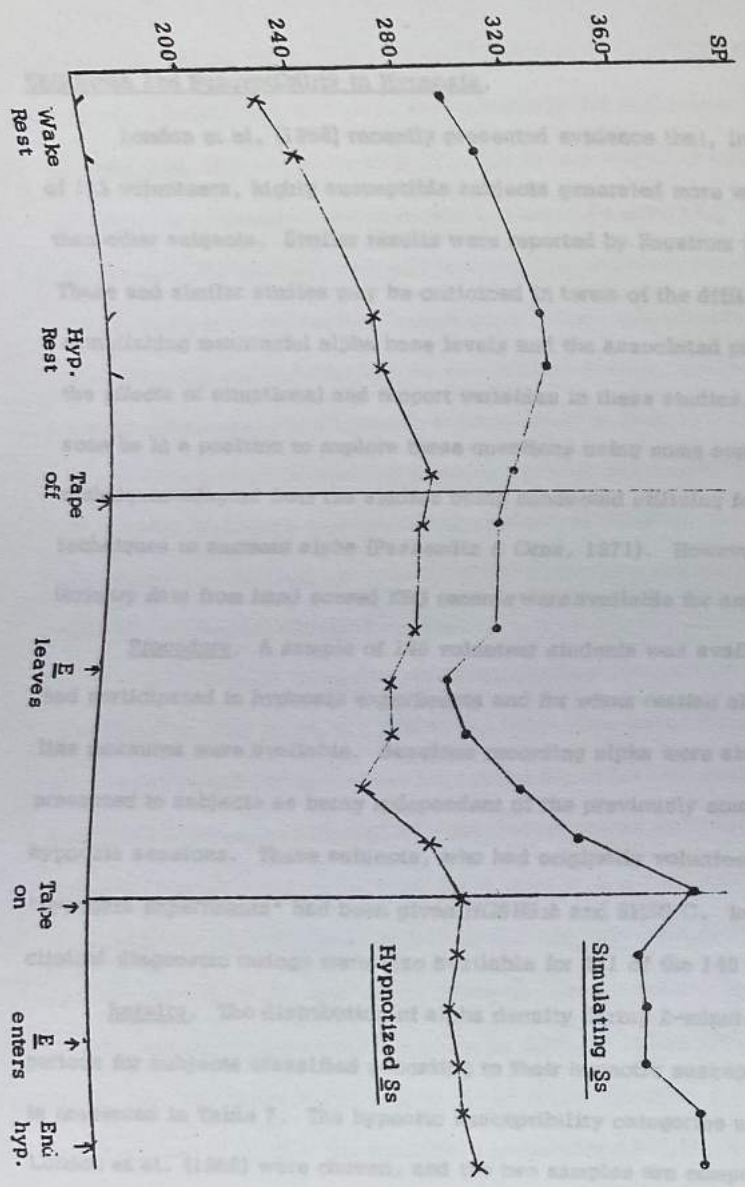


Figure 3.

Ongoing skin potential before, during, and after power failure.

Figure 3. There were no overall significant differences between the SP curves of the hypnotized and simulating subjects ($p > .25$). There were significant changes in SP throughout the session ($p < .01$) but the interaction was insignificant ($p > .10$). An analysis of simple effects indicated that the changes in SP during the session were limited to simulating subjects. For these subjects, changes in SP indicating increased arousal were observed when the power failure was terminated, i.e., as subjects awaited the experimenter's return. A similar increase in breathing rate was found for simulating subjects. Analysis of covariance, controlling the initial SP baseline differences between hypnotized and simulating subjects, did not alter these results.

Statistically, then, except for the arousal of the simulating subjects when the experimenter was about to return, the two SP curves are essentially the same. It strikes us as remarkable that the high involvement of simulating subjects still allows them to be virtually as "relaxed" physiologically (evaluated by SP levels) as hypnotized subjects.

3. EEG Alpha Activity and Hypnosis

The relationship between EEG alpha activity and hypnosis may be explored in two ways: (a) Do subjects who are highly susceptible to hypnosis have different waking brain wave patterns from those subjects who are insusceptible to hypnosis? (b) Are there any changes in alpha activity after hypnosis has been induced, particularly in deeply hypnotized subjects?

EEG Alpha and Susceptibility to Hypnosis.

London et al. (1968) recently presented evidence that, in a sample of 125 volunteers, highly susceptible subjects generated more waking alpha than other subjects. Similar results were reported by Engstrom (1970). These and similar studies may be criticized in terms of the difficulty in establishing meaningful alpha base levels and the associated problems of the effects of situational and rapport variables in these studies. We will soon be in a position to explore these questions using some sophisticated techniques adapted from the studies being conducted utilizing feedback techniques to augment alpha (Paskewitz & Orne, 1971). However, preliminary data from hand scored EEG records were available for analysis.

Procedure. A sample of 140 volunteer students was available who had participated in hypnosis experiments and for whom resting alpha baseline measures were available. Sessions recording alpha were always presented to subjects as being independent of the previously completed hypnosis sessions. These subjects, who had originally volunteered for "hypnosis experiments" had been given HGSHS:A and SHSS:C. Individual clinical diagnostic ratings were also available for 111 of the 140 subjects.

Results. The distribution of alpha density during 2-minute rest periods for subjects classified according to their hypnotic susceptibility is presented in Table 7. The hypnotic susceptibility categories used by London et al. (1968) were chosen, and the two samples are compared. In addition, subjects are reclassified according to SHSS:C scores, a more reliable estimate of hypnotic susceptibility. Although our data initially

Table 7

Mean percent alpha generated during 2 minutes rest for Ss differing in susceptibility to hypnosis.

	London et al.[a]		Evans[b]			
Hypnosis Score	HGSHS:A N	$\bar{X}$ percent alpha	HGSHS:A N	$\bar{X}$ percent alpha	SHSS:C N	$\bar{X}$ percent alpha
0-4	25	37	40	65	46	46
4-7	25	56	43	40	25	39
7-11	67	42	49	45	58	46
12	8	70	3	90	10	40
Total N	125		135		139	

a. From London et al. (1968)

b. Evans (unpublished data). All Ss received both HGSHS:A and SHSS:C (4 Ss who received SHSS:A instead of the group version eliminated).

appeared to confirm the exciting results of London et al. for those subjects who scored 12 on HGSHS:A, these subjects did not necessarily maintain their high scores on SHSS:C. The 40 insusceptible subjects displayed considerably more alpha (for a mean of 65 percent of the rest period) than the similarly selected insusceptible subjects (40 percent alpha during rest) reported by London et al. When subjects of medium susceptibility are included in both samples, no overall relationship between alpha density and hypnotic susceptibility is seen.

The lack of relationship between hypnotic susceptibility and alpha frequency, amplitude, and density is apparent in Table 8. No significant correlations were found between the alpha parameters and either HGSHS:A, SHSS:C, or clinical diagnostic ratings.

In an attempt to resolve the contradictions between our findings and those reported by others, and in the light of our evidence that SP changes reflected relaxation and situational variables, we examined the correlations between estimated hypnosis factor scores and baseline alpha density. The correlations between alpha density and total SHSS:C, motor suggestibility, and dissociation factors derived from SHSS:C were respectively -.02, +.01, and -.06. However, the correlation between alpha density and the imagery-relaxation cluster (defined by the SHSS:C dream, taste, fly, and boxes items) was in the predicted direction (+.17) but insignificant ($N = 33$). The tetrachoric correlation was .50, indicating a more complex nonlinear relationship. In fact, subjects with high scores never had poor alpha, but predictions about alpha density could not be

Table 8

Correlations between alpha activity characteristics and susceptibility to hypnosis.

Hypnosis	N	Frequency	Amplitude	Density	N	Density
HGSHS:A	60	-.19	.04	.02	135	-.08
SHSS:C	60	-.01	.03	-.02	139	-.02
Diagnostic	40	-.05	-.02	.13	111	.12

Note: All correlations insignificant ($p > .10$).

made if subjects scored low on the imagery-relaxation cluster.

A poorly defined picture emerges of an anxious subject, perhaps initially apprehensive about hypnosis, whose SP will change as he becomes less tense, who does not generate a great deal of alpha initially. As he becomes less apprehensive in the experimental situation over time, he relaxes, SP decreases (lowered arousal), alpha becomes disinhibited and increases in density, he feels sufficiently comfortable to "accept" his (limited) hypnotic experiences, thereby being willing to let himself go along with the situation to have new experiences. Thus, we would conclude that relationships between physiological measures and susceptibility to hypnosis are situationally determined, and that once stable baselines of both physiology and hypnotizability are determined, these apparent relationships no longer exist.

In summary, in spite of conflicting results, it is concluded that waking alpha frequency, density, and amplitude are probably not correlated with susceptibility to hypnosis.

EEG Alpha Change During Hypnosis.

Brady and Rosner (1966) reported anecdotally that some deeply hypnotized subjects showed greater alpha amplitude during hypnosis than they did in the waking state. A definitive study of this question would require that the relevant alpha parameter change under hypnosis from the waking level (recorded under similar conditions), and that a comparable change does not occur in insusceptible subjects appropriately motivated to experience hypnosis as well as they can. Two methodological techniques allow

adequate explorations of these questions: the motivated insusceptible subject paradigm of London and Fuhrer (1961), and the simulation model proposed by Orne (1959, 1969a). Definitive studies do not exist, but some preliminary data are available from a study involving simulating subjects.

Table 9 reports mean frequency, amplitude, and density of alpha for hypnotized and simulating subjects tested by a "blind" experimenter (Evans & Orne, 1971; Evans, Reich, & Orne, in preparation). Waking and hypnotic rest periods were presented identically by a tape recording, and were scored blind. Means are reported for both normal waking and deeply hypnotized (or simulating) conditions of eyes closed. Each mean is the average of three passive 2-minute rest periods.

There was a tendency ($p < .10$) for simulators to have higher alpha amplitude than hypnotized subjects, both in the normal waking state and when they were simulating hypnosis. Simulating subjects generated significantly more alpha than hypnotized subjects both when awake and when simulating hypnosis (about 65 percent alpha for simulators; about 25 percent for hypnotized subjects, $p < .001$). All subjects generated less alpha during hypnosis (or while simulating hypnosis) than during waking ($p < .01$). None of the analysis of variance interactions was significant. It may seem surprising that the highly alert simulating subjects generated alpha so readily during "hypnosis," more readily than relaxed hypnotized subjects. These results suggest, however, that merely being in a hypnotic trance does not necessarily alter frequency or augment amplitude of alpha activity. Indeed, it suggests that with passive hypnotized subjects drowsiness may

Table 9

Mean alpha characteristics for hypnotized Ss and simulating Ss before and after induction of hypnosis.

Group	Session	Frequency	Amplitude	Density (percent)
Hypnosis	Waking	10.16	7.89	27
(N = 12)	Hypnosis	10.43	7.98	17
Simulator	Waking	10.33	8.72	52
(N = 12)	"Hypnosis"	10.20	9.21	45
F: Real Vs. Simulator[a]		----	3.22*	13.15***
F: Waking Vs. Hypnosis[a]		----	1.20	8.08**

a. All interactions insignificant.

Note: * $p < .10$
** $p < .01$
*** $p < .001$

many of the studies were inconclusive. psychophysiology of hypnosis not identified

suppress alpha production. Once they are over their initial anxiety, simulators may relax sufficiently to produce high levels of alpha density: the situation prevents them from relaxing sufficiently to show physiological evidence of drowsiness.

4. Summary

Though a great deal of effort has been devoted to finding a reliable psychophysiological correlate of hypnosis, our findings to date have been disappointing. In part, we would attribute our lack of success to the relative inadequacy of our presently available psychophysiological tools as a means of elucidating the normal waking state. As psychophysiological techniques become more capable of identifying deployment of attention and similar psychological variables, meaningful physiological correlates of hypnosis may yet emerge.

It seems more likely, however, that it will not be possible to identify unique physiological correlates of hypnosis for the same reason that research has consistently failed to identify physiological differences between fear, anxiety, and euphoria. It now appears most plausible that the difference between these states is not so much in the physiological substrata but in more central cognitive processes. Similarly, physiological correlates of relaxation, spontaneous daydreaming, hypnosis, meditative states, and related phenomena may be similar or identical, though important behavioral and subjective differences exist between the phenomena.

F. STUDIES OF POSTHYPNOTIC AMNESIA

Posthypnotic amnesia is one of the more interesting phenomena of hypnosis. It is dramatic because of the ease with which it can be induced in appropriate subjects. The hypnotist merely suggests that, upon awakening from hypnosis, the subject will be unable to recall any of his hypnotic experiences until an appropriate cue word has been given. Even when a hypnotized subject does recall some of his experiences, he may have considerable difficulty, sometimes showing confusion about the sequence of events or such details as whether a suggestion of arm rigidity involved the left or right arm. It seems incongruous that some people could have so much difficulty describing what they had been doing during the preceding few minutes.

Most existing studies of posthypnotic amnesia have been quantitative and parametric in nature, or, with varying levels of sophistication, have been concerned with the question of whether amnesia involves some form of memory ablation, or whether the amnesia concept is best understood in terms of motivation, role playing, and compliance. Influenced by our clinically-relevant orientation, our studies on amnesia have been concerned with those qualitative aspects that may shed light on the mechanisms of amnesia (Orne, 1966b).

What is Recalled During Amnesia?

An important aspect of amnesia may reside within the nature of the experiences which are recalled. Success and failure have frequently been linked with recall. In one study an attempt was made to determine whether

subjects would be more likely to recall passed or failed items during the testing of amnesia (O'Connell, 1966).

Five samples of subjects given initial standardized tests of hypnotic susceptibility were analyzed for posthypnotic item recall. All samples showed evidence of selective recall favoring passed items compared to failed items. Four samples, however, showed greater selectivity among the low-scoring subjects, contrary to previous report. This evidence is interpreted as favoring an interpretation of selective recall in terms of an enhancement rather than a repression model.

Amnesia and Reversibility.

The primary evidence that amnesia is not a special form of forgetting is that it can be lifted on command. The temporary forgetting is reversible. Thus, in one study Nace and Orne (in preparation) reported that highly susceptible subjects recalled 2.95 items of SHSS:C after amnesia had been suggested, but recalled an additional 5.46 items when amnesia was lifted. Insusceptible subjects recalled 7.09 items during "amnesia," reversing only 1.36 items. It is worth noting that the total recall at the end of the session did not differ between these two groups (8.45 and 8.41, respectively), demonstrating that amnesia does not occur merely because the subject has a poor memory.

Reversibility was lawfully related to hypnotic susceptibility. The correlation between a reversibility ratio (ratio of amount reversed to the amount the subject could have maximally reversed, i.e. taking into account ceiling effects) and the amnesia score was .71, and with SHSS:C

was .62 (N=60). Not only is amnesia readily reversible, the recovery of memory for the hypnotic events is as potent an indicator of hypnotic amnesia as the original response to the suggested failure to recall.

Amnesia and Disorganization.

The difficulty experienced by many subjects trying successfully to recall some items is an impressive sign of the amnesic process. Indeed, we feel that it may be better to investigate the mechanisms involved in posthypnotic amnesia in those subjects who recall some of their experiences (as indexed by reversibility) rather than in those who have no memories at all.

Subjects with partial amnesia tended not to recall the first item on the scale that was administered as their first item of recall, and indeed, failed to place the items remembered in any kind of accurate temporal sequence. In contrast, susceptible subjects recalled the first item first almost invariably, and continued to recall items in the exact sequence they completed them.

The disorganized sequencing of recall during partial amnesia is quite lawfully related to hypnotic susceptibility. Indeed, amount of reversibility and degree of disorganization both can serve as criteria of amnesia, which correlate with hypnotizability at least as well as the usual measure of amnesia: the number of items forgotten.

Suggestions of posthypnotic amnesia appear to disrupt the normal cognitive operations of partially amnesic subjects: it is harder to retrieve the relevant materials because the context in which they are embedded is

obscured. There are marked similarities between this process and source amnesia, or the inability of some hypnotized subjects to place information in the context in which it was acquired.

Posthypnotic Source Amnesia.

Clinical fugue states, plagiarism, and the inability to remember the name of a familiar person, seem to be examples of pathological and normal amnesias which do not seem directly related to the traditional notion of amnesia in terms of amount forgotten. Instead of an amnesia for content, amnesia occurs for the context in which certain events occurred. Posthypnotic source amnesia provides a paradigm for studying this type of amnesia (Evans & Thorn, 1966).

While hypnotized, the subject is taught answers to questions which he previously did not know, such as the color of a heated amethyst. After hypnosis has been terminated, the subject is again asked these questions. Some subjects will retain the correct answers to the information taught during hypnosis, but when interrogated they will not understand how or where the information was obtained. New information is acquired, but the subject cannot remember its source or origin; he rationalizes the origin of the new knowledge.

Source amnesia does not necessarily occur only in deeply hypnotized subjects, though it does often occur in those deeply hypnotized subjects who forget everything that happened due to hypnosis. As source amnesia has not been observed in simulating subjects, it does not appear that it is a response to situational cues. The amnesia for the context of learning

may, of course, be a special case of the inability of partially amnesic subjects to place experiences in a relevant temporal context.

G. HYPNOSIS, SUGGESTIBILITY AND PERSUASIVE COMMUNICATION

In recent years many investigators have attempted to account for hypnotic phenomena in terms of motivational concepts. Largely on the basis of evidence described above, we feel quite comfortable in rejecting such accounts of hypnosis. This does not deny, of course, the importance of motivational factors in experimental (and clinical) contexts. The changes in pain tolerance and dynamometer strength of grip which can only be accounted for in motivational terms are dramatic examples of the effects of motivating subjects who are insusceptible to hypnosis. These effects, of course, are determined by the situational context in which hypnosis occurs rather than by the effects of hypnosis as such.

In a similar vein, many investigators, particularly in social psychology, have attempted to account for hypnotic phenomena in terms of suggestion. This is an older viewpoint, but we feel equally comfortable in rejecting suggestibility accounts of hypnosis. Evans (1965, 1967, 1968) has shown that hypnosis and the several manifestations of suggestibility are orthogonal. The relationship between hypnosis and suggestibility that is frequently reported is an artifact of using tests of suggestibility as measures of hypnosis. Certainly, if a subject responds to suggestions outside of hypnosis, he will respond to suggestions in hypnosis. If hypnosis is evaluated by the use of tests of suggestion, therefore, a correlation will occur merely because the suggestibility measure is highly reliable: it is a retest reliability correlation. However, if hypnosis is defined and evaluated objectively as a distortion of perception or memory the correlation essentially

disappears. For example, the correlation between standard measures such as the postural sway given before and after hypnosis is around .9, but the postural sway item on SHSS:A has an insignificant correlation with the total scale (Evans & Schmeidler, 1966). In fact, the correlation between suggestibility measures and hypnosis measures may depend on the expectations of the subject; correlating significantly when the subject sees them as measures of susceptibility, but insignificantly when tested in an independent context.

Suggestibility.

Suggestion is, of course, in many situations, a highly effective means of controlling behavior and influencing people persuasively. There are at least three types of suggestion which are uncorrelated with each other (Evans, 1967). Most investigations have been concerned with inducing motor responses (e.g., the postural sway). The work of Barber (1969) particularly demonstrates the wide range of physical and motor responses that can be influenced in this manner. A second component clearly involves imagery (traditionally studied by the heat illusion test) and is facilitated by relaxation. We showed that changes in SP and alpha activity following a hypnotic induction procedure were attributable to this variable (Evans, 1970). Imagery rather than hypnosis was implicated as the mechanism whereby optokinetic nystagmus was brought under voluntary control (Evans, Reich, & Orne, in preparation). This kind of suggestibility has been implicated in conditioning, and the resistance to extinction of sensory-conditioned hallucinations. The third kind of suggestibility is a

nebulous concept that relates to the more traditional notions of gullibility and persuasibility, particularly when influenced by a prestige figure. It is highly correlated with Asch's conformity paradigm: indeed the best measure is Asch's progressive lines test in which the pressure to confrom originates from the experimenter rather than peers. The potential use of the conformity model has been widely studied in social psychology.

We do not yet have sufficient data to indicate which, if any, of the types of suggestion relate to the situational variables which we have called the placebo effects of the hypnotic situation. Certainly the motor suggestibility and imagery dimensions are typically elicited in factor analytic studies of traditional hypnotic phenomena (along with a factor made up of the phenomena traditionally associated with deep hypnosis; Evans, 1965, 1968; Hammer, 1970).

Peer Influence on Hypnotic Behavior.

During the final year of this contract we have been investigating the effect of peer behavior on hypnosis. During a tape-recorded version of the group administered HGSHS:A, those subjects who sit next to each other tend to score about one item more alike on the 12 point scale than those subjects who sit farther apart (Evans & Mitchell, in preparation). This does not necessarily increase or decrease scale scores in a consistent direction. Some subjects seem to remain uninfluenced by the performance of their neighbors. The likelihood of having been influenced is not related to subsequently determined individual assessments of hypnotizability. In fact, those subjects classified as high, medium, or low on the individual

scales were equally prone to be influenced by their neighbors. When neighborly influence occurs, however, it significantly interferes with the ability of HGSHS:A to predict later hypnotizability (SHSS:C). Thus, the correlation between HGSHS:A and SHSS:C is significantly ($p < .01$) higher for uninfluenced subjects (.76) than for influenced subjects (.49).

The implications of this study are indeed important. We have isolated a significant source of social influence during hypnosis which is uncorrelated with susceptibility (or depth) of hypnosis. The similarities of this form of subtle interaction and conformity, and the mass contagion of crowd behavior are quite apparent. The advantage of the model is that it provides an unobtrusive measure of the influence process, rather than depending on stooges or modelling techniques usually required in such studies. It seems likely that the social influence occurring with some neighboring subjects during the group hypnosis session is similar in kind to the placebo effects of hypnosis referred to in our work on pain (McGlashan et al., 1969). While both kinds of influence have had dramatic effects on behavior, neither is correlated with hypnotic susceptibility.

Placebo Response and Hypnosis.

The placebo response involves the behavioral effects of the non-specific factors involved in drug taking, and in psychotherapy and other forms of treatment. We have isolated similar situationally determined effects during hypnotic analgesia. The increased tolerance of ischemic muscle pain occurring with a placebo, plausibly administered, was equivalent to and highly correlated with the increased tolerance following

hypnotic analgesia in subjects who were insusceptible to hypnosis, or who were deeply hypnotized but unable to subjectively experience the hypnotic analgesia suggestions. We have also shown that the placebo response is uncorrelated with standard scale scores of hypnotic susceptibility and also uncorrelated with representative tests of the different kinds of suggestibility (Evans, 1969). The lack of correlation between placebo response and suggestibility holds in both experimental and clinical settings (Evans, 1967).

The important finding that is emerging from this work on social influence, suggestibility and the placebo response is that we are consistently isolating influence processes which seem capable of affecting a wide range of behavior within the context of working with hypnosis. These processes are unrelated to depth of hypnosis and susceptibility to hypnosis, yet hypnosis appears to provide a striking paradigm in which they can be observed and studied.

H. OVERVIEW

A number of conclusions and generalizations based on our work and continuing surveillance of the literature can be made at this time. It seems clear that hypnosis is not a simple unified phenomenon. Some of its effects are confounded with those of suggestion and motivational factors; however, some intrinsic aspects seem much more closely related to the ability of individuals to daydream, fantasize, and to turn their attention inward away from the immediate environment. The dramatic effects which hypnosis can bring about can, in large part, be mimicked by non-hypnotized simulating individuals. While these individuals may reproduce the objective behavior, and even some of the physiological changes, their experience in the situation is drastically different. On the other hand, in hypnotizable subjects, non-hypnotic instructions to fantasize or even to simulate may elicit the set of processes that is usually brought about by techniques of hypnotic induction.

Our studies of hypnosis have served not only to clarify a considerable number of important specific questions about what hypnotized individuals can or cannot do because they are hypnotized, but have also led to new ways of conceptualizing and understanding human behavior. Certainly we cannot yet fully understand and explain all aspects of hypnosis, and some important questions of potential military significance remain unanswered. These studies

have, however, helped establish a clearer link between hypnotic phenomena and other better understood mental processes, and thereby have helped to integrate hypnosis into more general scientific psychology.

Our most recent efforts, in particular, seem highly promising. On the one hand, they have explored the relationship of hypnosis to more general issues of cognitive psychology, shedding light on the mechanisms by which posthypnotic suggestion and posthypnotic amnesia may take place. On the other hand, these studies have helped to distinguish between hypnosis and other phenomena that have traditionally been linked with it. It is now clear that suggestion, gullibility, the placebo response, and persuasive communication, while tangentially related, are not highly correlated with the process traditionally seen as hypnosis. Indeed, it would appear that at this time the most fruitful line of inquiry from the point of view of its military significance would be to explore further the nature of suggestion and influence communication since the mechanisms involved in these phenomena are intimately related to problems of psychological warfare, morale, leadership, and the reliability of personnel.

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